

A Network Model Framework for Prioritizing Wetland Conservation in the Great Plains: Toward a Theory of Connectivity among Ephemeral Depressional Wetlands

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Abstract - Playa wetlands are the primary habitat for numerous wetland-dependent species in the Southern Great Plains of North America. Plant and wildlife populations that inhabit these wetlands are reciprocally linked through the dispersal of individuals, propagules, and ultimately genes among local populations. We developed a framework using network models to conceptualize, represent, and analyze potential biological flows among 48,981 spatially discrete playa wetlands in the Southern Great Plains. We examined changes in connectivity patterns and assessed the relative importance of wetlands to maintaining these patterns by targeting wetlands for removal based on network-centrality metrics weighted by estimates of habitat quality and probability of inundation. We identified several distinct, broad-scale sub networks and phase transitions among playa wetlands in the Southern Plains. In particular, for organisms that can disperse ≥ 2 km, a dense and expansive wetland sub-network emerges in the Southern High Plains. This network was characterized by localized, densely connected wetland clusters at link distances (h) > 2 km but < 5 km and was most sensitive to changes in wetland availability (p) and configuration when $h = 4$ km, and $p = 0.2-0.4$. It transitioned to a single, large connected wetland system at broader spatial scales even when the proportion of inundated wetland was relatively low ($p = 0.2$). Our findings suggest that redundancy in the potential for broad- and fine-scale movements insulates this system from damage and facilitates system-wide connectivity among populations with different dispersal capacities. We discuss the application of this framework toward prioritizing wetlands for conservation in the Southern Great Plains and the development of a theory of connectivity for ephemeral wetland populations. We also discuss how our findings may be used to further research and conservation management efforts directed at ephemeral wetland populations in the northeastern US.

Sat-PM1-E-1

Raids and Relocations: Insights from Long-term Monitoring of Interactions Between Slavemaking Ants and Their Hosts

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Abstract - Among the most unusual of the many interspecific interactions affecting ant populations is the phenomenon of specialized slavemaking behavior. Slavemaking ants raid colonies of their host species and bring back brood to become a work force in their own nests. The captured brood mature in the slavemaker colony, where the enslaved workers care for slavemaker offspring, maintain the nest, and forage for food. In an 8-ha patch of forest on the SUNY Geneseo campus in western New York, 2 species of slavemaking ants, *Formica subintegra* and *F. pergandei*, both parasitize a locally abundant mound-nesting ant species, *F. glacialis*. Since 2008, over 1000 nest locations of *F. glacialis* have been mapped in this site, with approximately half of these nests representing currently active colonies. Over a 7-year-period, the raiding activity of 10–14 colonies of the slavemaking species has been monitored to determine the frequency and distance of raids and the identity of the host nests targeted. Long-term monitoring of slavemaking colonies suggests constraints on meeting their demand for host brood, despite the high density of *F. glacialis* nests. The raiding behavior of individual colonies varied considerably; some colonies had as many as 20 raids in a season. In the more successful raids, > 2000 host pupae were captured in a day. Examination of the size distribution of their slave populations suggests that they may often exploit smaller-than-average host colonies. Slavemaking colonies also exhibited frequent relocation: of 14 colonies tracked for at least 5 of 7 years, all but one has moved at least once by invading existing host nests; 9 colonies have moved at least 3 seasons over this period. Occasionally slavemaking ant colonies split either temporarily or for entire seasons to occupy several host nests. Slavemaking colonies also launched raids on neighboring slavemaker nests, sometimes resulting in their destruction. Genetic data providing information about colony structure and identity also inform our understanding of the constraints on and impacts of slavemaking ants. Our data contribute to an appreciation of the dynamics of this host-parasite interaction and its consequences for the most abundant ant species in this local community.

Sat-AM2-E-3

Southern Pine Beetle Expansion into Pitch Pine Areas

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Abstract - Increases in global mean temperatures over the last 50 years has favored the range expansion and increased population levels of *Dendroctonus frontalis* (Southern Pine Beetle [SPB]) and its associated pathogenic fungi blue stain in *Pinus rigida* (Pitch Pine). Historically, the range of *D. frontalis* extended throughout the southern and southeastern United States as well as New Jersey, Delaware, Pennsylvania, and Ohio. However, a warming climate has recently allowed this insect to expand its range to northern areas where beetles had previously been restricted by cold temperatures. The epidemic has recently expanded from New Jersey to Long Island (1500 acres) in 2014 and further north into Connecticut, Rhode Island, and Maine between 2015 and 2016. Primary defense against SPB and its associated fungus include oleoresin from resin ducts formed through the tree. Comparisons of resin ducts (number, density and size) and other anatomical features in conifers attacked by SPB were studied to determine their resistance capacity.

Sat-AM1-F-2

Mosquitoes and Zika Virus: Assessing the Threat

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Abstract - Zika virus was first discovered in Uganda in 1947 and remained an obscure mosquito-borne virus until it spread to Brazil in 2015 where it infected unprecedented numbers of people and caused thousands of birth defects. The virus has subsequently spread to other parts of Latin America, the Caribbean, and southern Florida, and is expected to infect millions more people within this region. In this presentation, Dr. Armstrong will give historical background about the global expansion of Zika virus, review the mosquito biology and transmission cycle of this virus, and discuss the potential for localized virus transmission and range expansion in the continental US.

Sun-PM2-J-2

Spatial Variation in the Diet of New York City Coyotes

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Abstract - Until recently, New York City's breeding *Canis latrans* (Coyote) population had remained restricted to the Bronx since the species first colonized New York City ~20 years ago. The known exception was 1 lone male Coyote living in a wooded area in Queens. Though NYC Coyotes lived in urban areas, their range mainly encompassed large parks with areas relatively undisturbed by humans. The first breeding pair of Coyotes in Queens were documented in an industrial area in 2016. Specifically, they occupied a wooded buffer surrounding the Elmjack little league baseball field and a recently constructed parking lot. The more urbanized range of the Elmjack Coyotes may result in a difference in diet between the Elmjack Coyotes and Coyotes living in more intact urban parks. To determine if this difference exists, we analyzed prey remains from over 150 coyote scats collected in 8 separate New York City parks from 2011 to 2016. Preliminary results indicate that the diet of Coyotes in more intact urban parks ($n = 119$ samples) mainly consists of small mammals (<6.0 kg; 17%), birds (15%), fruit/seed (11%), and *Odocoileus virginianus* (White-Tailed Deer; 10%). The Elmjack Coyotes' diet ($n = 44$) is also high in small mammals (11%), but contained fewer birds (7%), no Deer, and a small amount of fruit/seed (4%). There was a higher percentage of anthropogenic items in the Elmjack Coyotes' diet (26%) than in the diet of Coyotes in more intact urban parks (10%).

Sun-PM2-D-5

The Distribution of *Fraxinus profunda* (Pumpkin Ash) in New York

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Abstract - Wild populations of *Fraxinus profunda* (Pumpkin Ash) are documented from Bronx and New York counties in New York City, NY. The Bronx County population, roughly centered around Bronx Park, consists of 9 trees in 6 clusters. The other population, in Central Park, New York County, consists of 5 trees in 2 clusters. The largest, and presumably oldest tree in New York is a female tree located in the Bronx Zoo and was first collected in 1936. Today the tree is over 1.1 m in diameter. Thirteen of the New York trees are female and only 1 is male. The evidence presented here firmly establishes New York City as the northeastern-most extent of the species in North America. The nearest known populations are in Monmouth and Ocean counties, NJ. The species will be listed as S1, Endangered by the New York Natural Heritage Program.

Sat-PM2-C-2

Monitoring Northern Long-eared Bats on Long Island, NY

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Abstract - As white-nose syndrome (WNS) continues to threaten bat populations across eastern and central North America, there is an urgent need to better understand how populations are responding. Although *Myotis septentrionalis* (Northern Long-eared Bat) has suffered significant declines across much of its range, Long Island, NY, appears to support a relative abundance of the federally threatened bat. However, the current trend of this population is unknown. 2016 marked the second year of a pilot study to investigate the efficacy of passive acoustic sampling as a means of population monitoring for *M. septentrionalis*. We surveyed 8 different sites for a total of 65 detector-nights. *Myotis septentrionalis* were detected at 4 of the sample sites, including one site in Nassau County, about 6 km west of previous recent detections for this species and approaching the more heavily developed western side of Long Island. These data were combined with 65 detector-nights at 6 sites from 2015. Preliminary analyses found that the amount of surrounding development had a strong negative correlation with occupancy probabilities of *M. septentrionalis*. The species was more likely to be found in areas that were surrounded by deciduous and/or coniferous forests, indicating that a certain patch size of forested habitat may be necessary to support a population of *M. septentrionalis*. Our results suggest that the detection rate for *M. septentrionalis* on Long Island is relatively high compared to capture rates and detection rates from mobile surveys, indicating that the current USFWS passive acoustic monitoring protocols are sufficient for detecting *M. septentrionalis* if they are present. We conclude that passive acoustic sampling is a practical and effective method for monitoring *M. septentrionalis* on Long Island, and are developing a long-term, occupancy-based monitoring protocol to investigate population trends for this species and to support regulatory protection.

Sat-PM2-E-3

Initial Assessments of Anuran Communities at Southeastern Massachusetts Sites

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Abstract - Four sites in Southeastern Massachusetts (Cornell Pond, Turners Pond, New Bedford Reservoir, and Little Quittacas Pond) were surveyed for anuran advertisement vocalization from March 2016 to August 2016 using the Frog Watch USA method. No previous data for these sites had been submitted to the national Frog Watch USA database prior to this survey. Six species were recorded over the study period; however, all 6 species were recorded at just 1 study site, Turners Pond, on a single survey date. Considerable variation in vocalization intensity was found across the 4 sites. These results will establish a baseline to which future surveys of these sites can be compared.

Sat-PM1-D-3

Pits and Mounds: The Charismatic Microtopography of the New England Forest

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Abstract - Pit-and-mound microtopography is an important structural component of most forests, influencing soil processes and habitat diversity. These features have likely diminished in New England forests since European settlement, as a result of land-clearing and repeated logging, followed by second-growth forest composed of smaller trees. The implications of land-use history and forest development on pit-mound size, distribution, longevity, and ecological function are unexplored. Likewise, although several studies estimate pit-mound longevity, there is scant direct information on the rates of erosion and physical alteration of these structures over time. We compare a simulated hurricane experiment initiated in 1990 in second-growth forest (the pulldown) and an old-growth forest that was blown down by a hurricane in 1938 (Pisgah) to examine these issues. Repeated measurements of individual pit-mound structures in the pulldown revealed that mound height diminished rapidly, but mound volume declined much more gradually as soil from the mound tops eroded and spread around the mound base. Although 40% of mounds in the pulldown were >1 m tall immediately after the manipulation, after 25 years, maximum mound height was 0.9 m. In contrast, 11% of mounds at Pisgah remained >1 m tall in 1989, 50 years after blowdown. At Pisgah, fewer, larger mounds comprised a similar areal coverage as at the pulldown. Pit-mound structures are thus a diminished component of second-growth forest, and silvicultural systems designed to restore old-growth characteristics could include measures to preserve and enhance pit-mound features, as well as to cultivate large-diameter trees that will eventually become the large, long-lasting pit-mounds of the future. At both sites, trees, especially *Betula* spp. (birch), preferred mounds to undisturbed ground. Trees avoided pits at Pisgah, but not at the pulldown. Mounds have a greater impact on niche diversity in old-growth forests by providing opportunities for early–mid-successional species in forests dominated by late-successional trees.

Sat-PM2-F-3

Ecology of Alpine Snowbank Communities of Mt. Washington, NH

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Abstract - Alpine snowbank communities are rare, diverse ecosystems found in the Northeast only in sheltered sites above treeline. My work focuses on how the duration of snowpack, along with temperature, soil moisture, and light level affects plant community composition and phenology at snowbank sites on Mt. Washington, NH. Species richness at Alpine Garden sites was lower compared to sites near the Lakes of the Clouds hut. Ordinations showed a consistent turnover in community composition across the snowmelt gradient, including an inverse relationship in both diversity and richness between vascular plants and lichens; no transition in these variables was evident in bryophytes. Future work will focus on relating these findings to measurements of snowpack, plant traits, and phenology. Second, seeds of 2 snowbank herbs, *Chamaepericlymenum canadense* (Bunchberry Dogwood) and *Clintonia borealis* (Bluebead Lily), were collected from both high- and low-elevation sources, and are being grown in a common garden. Variation in plant traits or phenology between populations may provide evidence for genetic differentiation and/or local adaptation, as well as the increased conservation status of alpine ecotypes. Alpine areas have been shown to be disproportionately affected by climate change. Snowbank communities are threatened by altered precipitation patterns, and may act as sensitive indicators of change in the Northeast.

Sun-AM2-C-4

Environmental Correlates of Abundance and Impact of the Invasive Asian Shore Crab (*Hemigrapsus sanguineus*)

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Abstract - *Hemigrapsus sanguineus* (Asian Shore Crab) is a widespread invasive species that has caused dramatic declines in abundance and, putatively, diversity of native organisms on rocky shores of North America. Despite its potentially devastating effects on the native biota, rigorous studies of the factors that influence its abundance and its effects on biodiversity are lacking. We sampled macroinvertebrate assemblages at 10 rocky intertidal sites in southern New England and characterized each site using a suite of environmental (e.g., latitude, wave exposure), habitat (e.g., rock cover, algal cover, rock size), and anthropogenic (e.g., population density, distance to roads) variables. No single variable strongly predicted Asian Shore Crab abundance, but a suite of variables including latitude and wave exposure was more successful. Although Asian Shore Crab densities correlated negatively with some prey species (e.g., *Mytilus edulis* [Blue Mussel]), we observed no clear effect on biodiversity. Continued sampling will be used to verify this pattern and examine temporal trends.

Sat-PM1-J-4

Climate-driven Diversity Changes Revealed by a Resurvey of Odonata in Eastern Massachusetts

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Abstract - A resurvey of Odonata at Ponkapoag Pond (Norfolk County, MA) was conducted in 2015 and 2016, with results compared to data collected 1966–1971. Mean April–August temperatures at the site have increased between 1966 and 2016 at a rate of 0.29 °C per decade (± 0.06 SE, $P < 0.001$). Species diversity at the site was predicted to increase as a result, with southern species expanding their ranges into the region. Resurvey results support this prediction, with 7 of 12 new species detected representing species near the northeastern extent of their current ranges. This study adds further support to the evidence that climate change is facilitating the northward range expansion of a variety of taxa in North America.

Sun-AM2-J-2

It's All in the Timing; Investigating Species-specific Phenological Strategies of Dominant Temperate Shrubs

Sarah T. Bois (Linda Loring Nature Foundation, Nantucket, MA; stbois@llnf.org)

Abstract - Investigating patterns of plant phenology provides insights into the ecological processes organizing a plant community. While large-scale patterns of phenological responses are informative on a regional scale, species-specific response to microsite differences may be more beneficial to local conservation and land-management efforts when determining best practices in light of a changing climate. We use Nantucket Island, MA, as a study system where regional mainland patterns of phenological responses may not be applicable. As climate change has been shown to shift spring leaf-out and flowering times, there are significant implications for the globally rare sandplain grassland and heathland habitats found on Nantucket. We monitored 8 native, dominant shrubs at 8 microsites across 42 ha (104 ac) of sandplain grassland/heathland habitat for multiple growing seasons. Field observations were paired with twig-warming experiments to investigate the potential for species to take advantage of an earlier spring. In investigating common, native shrubs, we seek to understand how a community, driven by its dominant species, may change with warming spring temperatures. Phenological responses were species-specific with some responding more to microsite variation in temperature than to site-wide temperature averages. These species tend to be those that break bud first (e.g., *Vaccinium angustifolium* [Lowbush Blueberry] and *Prunus serotina* [Black Cherry]). Early leaf-out plants typically have physiological trade-offs to minimize leaf damage that make them more resistant to late frosts. These species that can “take advantage” of small differences based on microsite, may be more nimble in responding to future climate change scenarios including earlier onset of spring, and still be less vulnerable to late frosts. Species with late budburst (e.g., *Morella caroliniensis* [Southern Bayberry] and *Viburnum dentatum* [Arrowwood Viburnum]) responded more to site-wide temperatures within each year. It is the “moderate” species (e.g., *Gaylussacia baccata* [Black Huckleberry] and *Quercus ilicifolia* [Bear Oak]) that may be more vulnerable physiologically to late frost damage while breaking bud earlier in response to microsite warming in the early spring. Differential climate sensitivities have implications for the assemblages of shrub communities in these threatened systems with predicted warmer temperatures.

Sat-AM1-D-2

Mass-Rearing for Community Releases of *Sasajiscymnus tsugae* for Biological Control of Hemlock Woolly Adelgid

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Abstract - *Sasajiscymnus tsugae* (formerly *Pseudoscymnus tsugae*) was first discovered in Honshu, Japan in 1992 as an important coccinellid predator of the damaging hemlock pest, *Adelges tsugae* (Hemlock Woolly Adelgid [HWA]). This presentation traces the development of current successful procedures for mass-rearing this beetle predator from its early 1990s importation and research of its biology and potential at the USDA Forest Service quarantine laboratory in Ansonia, CT, and subsequently at the Valley Laboratory, the Connecticut Agricultural Experiment Station in Windsor, CT. This early research indicated the ability to readily mass-rear *S. tsugae*, a critical factor in any biological control program. Along the way, careful federal environmental assessments determined that there were no significant adverse environmental impacts posed by the beetle, and permission for multi-state field releases was granted by USDA APHIS and USDA Forest Service. *Sasajiscymnus tsugae* is now the most abundant and widely released biological control agent of HWA in the eastern United States. It is the only HWA predator that is commercially reared and available to the public and the success of long-term community releases in Pennsylvania will be highlighted in this presentation.

Sun-AM2-F-4

Conserving Ash Trees in the Northeastern United States: A Multi-disciplinary Approach

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Abstract - Species of the genus *Fraxinus* (ash), are under threat throughout much of their geographic ranges. These threats include a rapidly changing climate, a fungus, *Hymenoscyphus fraxineus*, causing a disease known as ash dieback of trees in much of Europe, and an invasive beetle, *Agrilus planipennis* (Emerald Ash Borer [EAB]), causing virtually total mortality of individuals of certain ash species in North America. Detected in 2002 near Detroit, MI, the EAB has spread to ash trees in 25 US states and 2 Canadian provinces. Early efforts to eradicate EAB gave way to attempts to contain/manage this invasive pest through establishment of quarantine zones, discouraging the movement of firewood, applying insecticides, introducing parasitic wasps, and conducting hybrid and traditional breeding programs. The New York Botanical Garden (NYBG), in an effort to contribute to ash conservation in the northeastern US, in 2016 assembled a multi-disciplinary, multi-institutional team to determine: (1) how many species of ashes are there in the northeastern US; (2) how are these species related; and (3) how can ash species be easily identified, particularly if leaves, stems, and fruits are not present simultaneously. A forthcoming taxonomic treatment of *Fraxinus* for the *Flora of North America* will recognize 19 species; however, recent molecular studies of the genus worldwide suggest there may be as many as 21 species in North America. Within the Northeast, the NYBG team is focused primarily on the large, heterogeneous section *Melioides*, which includes the most EAB-susceptible white ash complex. The project is using the latest DNA-based data and technology, combined with flow-cytometry and traditional morphological study. The goal of producing a phylogeny based on DNA, ploidy level, and morphological traits will result in a valuable tool for ongoing ash-breeding programs such as those of the US Forest Service. Identifying closely related, but resistant species will facilitate the breeding of resistant trees and the search for genetic markers associated with resistance. The project will culminate with a public symposium on ash conservation in the autumn of 2017. This presentation reports on the progress to date with respect to the project's collection, analysis, and outreach components.

Sat-PM2-C-1

How White-tailed Deer Overabundance Changes Plant Communities: Baseline Exclosure Data and Methodologies

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Abstract - *Odocoileus virginianus* (White-tailed Deer) herbivory from human-mediated overpopulation has had a multitude of detrimental effects on plant communities in forest ecosystems within North America. To measure how deer change plant community composition over time, we constructed 4 fenced deer exclosures and delineated 4 unfenced control plots in Brockport, NY, within a deciduous forest fragment during the spring of 2016. Understory and overstory plant species composition was then measured across plots and supplemented with native species plantings. This presentation will discuss exclosure placement considerations, community composition sampling techniques, comparative results from baseline data, and estimates of deer population abundance at a landscape-level.

Sat-AM2-C-1

Putting all your Eggs in a Small Number of Baskets: Daily Occurrence of *Operophtera* (Lepidoptera: Geometridae) in Carlisle, MA, 2012–2016

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Abstract - As part of a larger study of moth seasonality, variable occurrences of male moths of the genus *Operophtera* were counted daily between 2012 and 2016 from photographs taken at the porch lights at a residence in Carlisle, MA. It is likely that the majority of Carlisle specimens are *O. brumata* (Winter Moth), which is currently in an outbreak in eastern New England. The general pattern of seasonal occurrence was the similar in all years, with animals occurring from the first week of November to early January, with the majority from mid-November to mid-December. The total numbers year to year were 975 (2012), 1032 (2013), 1385 (2014), 3306 (2015), and 1290 (2016) for a grand total of 7988. The daily data suggest 2 unequal peaks of occurrence, perhaps corresponding to *O. brumata* and *O. bruceata* (Bruce Spanworm), species that cannot be distinguished from each other in photographs. The daily differences in occurrence were extreme, with greater moth numbers correlated to warmer nights. More than 1000 moths were counted in just 1 night, and more than 46% of the total were observed during the 10 nights with highest occurrence. The development of larvae within *Operophtera* eggs is known to be highly temperature dependent, and larval eclosion needs to occur in synchrony with bud burst of favored host plants. The implications for concentration of breeding on a few nights in an era of climate change will be discussed.

Sat-AM1-E-3

A Provisional Reassessment of Taxonomic Variation among New England Ashes (Oleaceae: *Fraxinus*)

Julian Campbell (Bluegrass Woodland Restoration Center, Lexington, KY; julian.campbell@twc.com)

Abstract - Taxonomic problems in *Fraxinus* section *Melioides* (Green/Red and White Ashes) of New England and adjacent regions are reviewed, together with comparison to *F. nigra* (Black Ash). Within *F. pennsylvanica* sensu lato (Green/Red Ash), a distinction is made between largely southern/eastern plants (referable to var. *subintegerrima* and var. *pennsylvanica**) and largely northern/western plants (referable to var. *campestris* and var. *austinii**). The latter include the common cultivar “Marshall’s Seedless”. They tend to have smaller leaves, shorter petiolules, more leaflet serration, larger buds relative to leaf scars, and smaller samaras. In both groups, more pubescent variants (*) tend to have larger samaras, and may also be usefully segregated. *F. profunda* (Pumpkin Ash) is generally assumed to be a distinct hexaploid species, but based on only one previously reported chromosome count, and, even with fruits, there is uncertainty in distinguishing some collections from *F. pennsylvanica*. White Ashes have been interpreted as a polyploid series (*americana* = 2x, *smallii* = 4x, *biltmoreana* = 6x) based largely on cytological studies during 1947–1983, but there have been few reliable chromosome-counts in polyploids and these lack supporting collections. Recent results from flow cytometry indicate only hexaploids among plants referable to *F. smallii* from east-central states. Relatively reliable reports of tetraploids are more restricted to southern regions than was suggested by Guy Nesom in 2010. The only obvious difference between *smallii* and *biltmoreana* is that the latter is more densely pubescent, especially on rachises and young twigs. It is suggested that most plants referable to *F. smallii* should be treated as a variety of *F. biltmoreana*. Diploid *F. americana* (sensu stricto) remains quite variable in pubescence and in samara size, which displays a bimodal tendency, but there is no obvious basis yet for further division of this species into varieties. This taxonomic scheme is supported by keys, state-distribution maps, principal components analysis of morphometric data from 160 collections, and frequency distributions of samara sizes.

Sat-PM2-C-3

Potential Expansion of Late Successional and Old-growth Stands in the Northern Forest Landscape under Current and Future Logging Regimes

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Abstract - Late-successional and old-growth forests remain rare in the northeastern US. What remains, mostly concentrated in New York's Adirondack Park, has been altered by a variety of inadvertent human impacts, including acid deposition and introduced forest pests and pathogens, particularly beech bark disease. While only a small fraction of forestland in the region is legally protected from logging, a variety of physical, social, and economic factors determine the likelihood that a stand will be logged, and a much larger fraction of the landscape may currently have little to no probability of logging. Furthermore, there has been a sea-change in northeastern logging regimes over the past 50 years. In most forest types, partial harvesting is now the predominant silvicultural system. These factors lead to the prediction that the fraction of the northern forest landscape in late-successional and old-growth conditions could increase substantially over the next century, and that the average aboveground tree biomass of forests in the region could roughly double, representing an important continued source of carbon sequestration. Predictions of the steady-state biomass and structure in late-successional and old-growth northern forests are hampered by the dearth of data on growth and mortality of very large trees. Even large national forest inventory datasets (FIA) contain too few observations on very large trees to accurately predict species-specific variation in survival of large trees. Plot-based studies of current old-growth forest remnants help constrain predictions of the potential landscape-scale distribution of structure and carbon storage in late-successional and old-growth forests. But given the multitude of potential inadvertent human impacts even in unlogged stands, including climate change and continued spread of introduced pests and pathogens such as *Adelges tsugae* (Hemlock Woolly Adelgid), mechanistic models of forest dynamics represent an important tool to integrate these processes in predictions of changes in the northern forest landscape over the next century.

Sat-PM2-F-1

Stress in the City: Influence of Landscape-scale Development on Chronic Stress Levels in Bobcats

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Abstract - *Lynx rufus* (Bobcat) populations were drastically reduced in New Hampshire in the late 20th century, but successful conservation efforts led to their resurgence in the past 2 decades. In that time, human population and development have greatly increased. Subsequently, Bobcats have begun to take advantage of human-altered habitats, a process known as synurbization. Although such habitats can support Bobcats, the dynamic nature of urban and suburban areas creates a landscape of persistent and novel stressors for this typically reclusive species. The negative effects of chronic stress include increased susceptibility to disease, decreased reproduction, and impaired growth and healing. To determine if Bobcats living in developed areas experience increased levels of chronic stress, we collaborated with state wildlife agencies, conservation organizations, and individuals across New England to collect hair samples from legally harvested, road-killed, or nuisance Bobcats. Cortisol is released into the bloodstream as part of the stress response and is incorporated into growing hair proportionally to systemic levels. Hence, cortisol levels in hair represent an average of systemic cortisol during the hair's growing phase and can be used as an index of chronic stress in individuals. Cortisol was detected in hair samples using a cortisol-specific enzyme-linked immunosorbent assay (ELISA), and levels were modeled with individual characteristics and landscape variables from the site of capture. Results show sex-biased variation in chronic stress, with females having higher cortisol levels ($P = 0.006$). Neither area of body sampled (foot, hip) nor season of capture (fall, winter, breeding, spring) were significantly related to cortisol levels, but levels were highest during breeding. Cortisol levels were positively correlated to metrics of development in the town of capture (mean = 77.1 km²). The role of development on Bobcat stress was scale dependent; development at the wildlife management unit scale (mean = 1429.7 km²) was not as strongly related to cortisol levels, suggesting local conditions have greater influence on the stress response. This study will help elucidate how synurbization, an increasingly prevalent trend in wildlife species, may lead to ecological traps and negative long-term effects on a carnivore population.

Sun-PM2-D-4

Geomapping the Distribution of Cultivated *Metasequoia glyptostroboides* Trees in the Northeastern United States

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Abstract - The genus *Metasequoia*, a member of the Sequoioideae subfamily, was initially based on fossil remains before its living species, *M. glyptostroboides* (Dawn Redwood), was discovered in south-central China. Modern *Metasequoia* populations are native to Hubei, Hunan, and Chongqing in China, but are capable of surviving in environments in most parts of the world, as shown from the fossil records. In December 1947, the first package of *M. glyptostroboides* seeds were collected and distributed throughout the world to various scientists for study and cultivation in botanical and private gardens. As a result, Dawn Redwoods are now widely planted as ornamental trees and some planted trees have already reached 25–40 m (82–131 ft) in height and 1–1.3 m (3.3–4.3 ft) in trunk diameter, despite being in cultivation for less than seventy years. In cultivation, *M. glyptostroboides* is hardy to USDA Zone 5, tolerating temperatures as low as -32 °C (-25 °F) and thriving in soggy, waterlogged soils, but may be sensitive to drought conditions and inadequate water availability. *Metasequoia glyptostroboides* will grow well in urban areas in the Midwest, Southeast, and East Coast of North America, due to their fast growth rate and tolerance for air pollution. The focus of this study is the assembly of published and unpublished information in order to create a database and geomap of all of the currently existing plants, native and cultivated, of *M. glyptostroboides*. The interactive map is ultimately intended to be available online for *Metasequoia* researchers worldwide, so as to permit updating the locational and descriptive information for living trees. Currently, our efforts are focused on setting up the GIS mapping system, designing and assembling a database for the presence of *M. glyptostroboides* trees, and creating an interactive geomap to show their distribution patterns in the northeastern US, particularly the New England States of Connecticut, Rhode Island, Massachusetts, and Maine. These efforts will allow for better visualization and understanding of the current range and abundance of the species as well as facilitate access to and sharing of information on the species, which in turn will aid and encourage future research that might test various genetic, environmental and paleo-environmental hypotheses.

Sun-PM2-F-4

Climate-Change Impacts in the Northeast on HWA and its Coccinellid Predator from Japan, *Sasajiscymnus tsugae*

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Abstract - *Adelges tsugae*, (Hemlock Woolly Adelgid [HWA]) is a serious and invasive pest of *Tsuga canadensis* (Eastern Hemlock) and *Tsuga caroliniana* (Carolina Hemlock) in the eastern United States, with its lineage source in southern Japan. Its native Japanese coccinellid predator, *Sasajiscymnus* (formerly *Pseudoscymnus*) *tsugae*, was also collected from southern Honshu, Japan, and was the first biological control agent of HWA introduced into the eastern United States. Research showed that *S. tsugae* was readily established in Connecticut from 1995 to 2001. Long-term research in Connecticut has recently shed light on the role and impact of unpredictable winters in the northeast on populations of HWA. The winter-spring generation of HWA in Connecticut has recently been dramatically reduced by consecutive adverse winters, with consequences for introduced adelgid predators. As the Northeast climate changes, Eastern Hemlock ecosystems are also increasingly threatened by frequent and prolonged droughts and other biotic and abiotic stressors. The biology and predation plasticity of *S. tsugae* is highlighted to indicate the often-overlooked ability of this species to exploit fluctuating HWA populations on hemlocks over an extended season in an unpredictable climate.

Sun-AM2-F-3

Local Prevalence and Strain Diversity of *Borrelia burgdorferi* in *Peromyscus leucopus* and *Ixodes scapularis*

Presenter: Kacie Chern (Northeast Wildlife DNA Laboratory, East Stroudsburg University, East Stroudsburg, PA; kchern@live.esu.edu)

Abstract - Lyme disease is now the most common vector-borne disease in the United States. Lyme disease victims experience extremely varied severity of symptoms, ranging from barely any symptoms at all to lifelong suffering and neurological damage. The first aim of this investigation is to compare multiple collection seasons to determine prevalence of *Borrelia burgdorferi*, the etiologic agent of Lyme disease, in *Ixodes scapularis* (Blacklegged Ticks), the vector of *B. burgdorferi*, and *Peromyscus leucopus* (White-footed Mice), the predominant reservoir host of the bacterium in the northeast. The polymerase chain reaction (PCR) was used to compare urinary bladder, spleen, heart, and ear biopsy samples from *P. leucopus* for the presence of *B. burgdorferi*. Additionally, it has been established that certain clinical strains in broader genotypic categories are associated with differing symptomatology in humans and in mice. The present study is further investigating these strains seeking to determine whether certain strains have proclivities for one tissue or another in mice in the environment. Samples have been collected during 2014, 2015, and 2016 from the same geographic area in northern New Jersey and select sites in northeast Pennsylvania and are currently in testing.

Sun-PM2-J-4

Food Resources Alter the Community Composition of Arboreal-Foraging Ants in Temperate Forests

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Abstract - Ants are conspicuous members of both forest-floor and arboreal food webs in temperate forests. Food resources can dramatically shape the composition of ant communities, but it is unclear how food resources gained from predation (caterpillars) and mutualism (sap-feeding Hemiptera) might alter the arboreal-foraging ant community. We examined the role of caterpillar abundance and sap-feeder abundance on ant communities, comparing ants collected from both branch-beating and pitfall traps. We found that sap-feeding Hemiptera, like treehoppers (Membracidae), restructured arboreal ant communities, but caterpillar abundance did not. Even though Membracidae had large impacts on arboreal-foraging ant communities, they had no impact on forest-floor ant community composition. Additionally, we found evidence that a specific subset of the total ant community was found participating in arboreal food webs, while the remaining ant community did not forage above the litter layer.

Sat-AM2-E-2

MA Audubon Society's Spadefoot Toad (*Scaphiopus holbrookii*) Headstart Program: A Place-Based Education Project for Cape Cod School Children

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Abstract - Place-Based Education (PBE) occurs when children, teachers, and adults in the community use the social, cultural, and natural environment in which they live as an inquiry-based learning laboratory to gain knowledge and skills across the curriculum. Staff at Mass Audubon's Long Pasture Sanctuary have developed a PBE project involving teachers and schoolchildren on Cape Cod to restore critical wetlands as a means to conserve an endangered species. *Scaphiopus holbrookii* (Eastern Spadefoot Toad) has been documented in only 32 localities in Massachusetts since 1982 and is threatened due to loss of vernal pool and upland habitat plus associated impacts including pesticides and vehicle mortalities. Our project involves students and teachers, primarily in Middle School classrooms, in a manner that supports endangered species conservation while at the same time satisfying Massachusetts state curriculum requirements for STEM. Students captive-raise ("headstart") wild-caught tadpoles collected from one of only a few remaining viable breeding populations on Cape Cod. Students record growth and development during care/husbandry. Upon completion of metamorphosis in the classroom, "headstarted" toads are translocated into newly restored wetlands on MA Audubon properties. Teachers and students are offered a project introduction with accompanying hands-on classroom exercises, a separate laboratory lesson geared toward one or more aspects of the project, and a follow-up field trip to the site of an extant Spadefoot Toad population or the new translocation site. This project balances a combination of outdoor environmental education and PBE to create opportunities for students to think independently, improve interactive communication skills by reporting their research findings, take a multidisciplinary approach to learning, and address local community environmental concerns. It is our hope that this project will not only educate students but empower them with a sense of regional pride to actively participate in environmental conservation as they grow older.

Sun-PM2-C-4

A 23-year Field Study of Connecticut's 3 Most Common Swallowtail Butterflies: *Papilio glaucus* (Tiger Swallowtail), *Papilio troilus* (Spicebush Swallowtail), and *Papilio polyxenes* (Black Swallowtail)

Victor O. DeMasi (Yale University Peabody Museum of Natural History, New Haven Ct.; victormonarch@yahoo.com)

Abstract - Over a 23-year period, I captured, marked, assessed to condition, released, and recaptured Connecticut populations of Papilionidae. Wing damage, attributed to avian attack and consisting of tears and deletions, was high in comparison to similar studies and variable from year to year. Bird attacks were never observed and are believed to have taken place during roosting. The highest years of wing damage did not necessarily result in lower recapture rates of individuals. The "search image" concept of predation is discussed. The dark morph of *Papilio glaucus* (Tiger Swallowtail) is a batesian mimic that occurs in this population as a low percentage and is outside the range of the aposematic model *Battus philenor* (Pipevine Swallowtail). Dark morph *P. glaucus* showed an incidence of wing damage similar to the yellow morph of *P. glaucus*. In this population, dark morph *P. glaucus* seems to enjoy no protection from predator attack. In the course of the 23 field seasons, *Papilio polyxenes* (Black Swallowtail) disappeared from the site. The local extirpation is attributed to an invasive plant.

Sat-AM1-E-4

Defining Habitat Characteristics of Four Rare Alpine Plant Species in the Presidential Mountain Range, New Hampshire

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Abstract - The alpine plant communities of the Presidential Range in the White Mountains of New Hampshire are fragile systems that support a wide diversity of plant species including several rare and endemic species. Due to the fragility of these systems, they are among the first to show the effects from region-wide perturbations such as global climate change. Defining the current ecology of the environments in which these rare plants exist is the baseline information required to inform conservation strategies and monitoring of alpine plant communities in the face of climate changes. We will study 4 different rare alpine plant species *Arctous alpine* (Alpine-bearberry), *Salix herbacea* (Snow-bed Willow), *Harrimanella hypoides* (Moss Plant), and *Geum Peckii* (Mountain Avens) across the high peaks of northern NH, defining the ecology and habitats of each species. At each location where these species are found data will be collected on: (1) topographic variables including aspect, slope, slope position, and elevation; (2) soil characteristics including pH, depth, and total organic carbon; and (3) plant community characteristics including the number of individuals of each species, the percent cover of surrounding plants, and the type of habitat and plant community. These known locations will be photo-documented for future monitoring to help in determining if the population size of each species is changing over time. A better understanding of the ecology and habitats of these rare plants and documented population change over time are necessary to inform best land management policies that will preserve these rare species.

Sun-AM1-D-1

Analysis of Seasonal Temporal Variation of Soundscapes in Western New York

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Abstract - Analysis of soundscapes may provide a way to quantify the biodiversity and examine the impact of anthropogenic noise on species in an area. Beginning in the summer of 2016, I analyzed soundscapes in forest plots in western New York. This habitat, especially during the spring and summer months, is crucial for avian species, among others, when they are acoustically communicating in search for a mate, communicating with offspring, or warning others about predators. We present analyses of the seasonal temporal variation of 4 soundscapes in western New York. Specifically, we determined whether seasonal variation of biodiversity was reflected in these soundscapes by using soundscape-derived measures of biodiversity. I obtained three 30-minute recordings each sample day—morning, afternoon, and evening—at both the center and edge of each habitat using a Song Meter SM4. I performed these recordings once in the early summer months from May to June and once in the late summer months from August to September. We used Raven Pro software to determine the relative amounts of biophony, geophony, and anthropophony in the soundscapes. Using the soundecology package in R Statistical Software, we determined the acoustic diversity index (ADI) and the acoustic complexity index (ACI) for each soundscape. These indices use different properties of sound to make a prediction of how much biodiversity is encompassing a given soundscape. Using multiple statistical tests, we then compared these values across the 2 time periods to understand how these measures of diversity changed with the seasonal gradient. The methods we employed could potentially be used to document the level of biodiversity in healthy forest plots, or show the success of conservation efforts, without the traditional but disruptive assessments of biodiversity that typically require species tagging and/or counts. We present this research as a first step toward achieving a thorough understanding of the temporal and spatial variation of western New York soundscapes that is required for scientists to accurately predict how organisms and environments will react to the environmental stresses found in modern acoustic environments.

Sun-PM2-C-1

Biogeography, Taxonomy, and Evolutionary Affinities of Northeastern Thelypteridaceae

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Abstract - The fern family Thelypteridaceae comprises nearly 1000 species. Taxonomists have recognized as few as one genus to as many as 32 genera within it. Microscopic diagnostic characters, a somewhat uniform macromorphology across the family, and limited taxon sampling for molecular data have led to imperfect taxonomic concepts. Five species are native to the Northeast, representing distantly related lineages within the family. A fossil-calibrated multi-gene phylogeny coupled with biogeographical analyses are used to propose hypotheses for the biogeographic origins of these species in the Northeast. Close relatives of the northeastern taxa occur in the Pacific Northwest, northern Asia, tropical Asia, Europe, and Africa. Are these distributions the result of Gondwanan vicariance, boreotropical migrations, long-distance dispersal events, or more recent introductions? Evidence and taxonomic implications will be discussed.

Sat-AM2-D-3

The Ecological Consequences of Light Pollution

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Abstract - Without hyperbole, addressing and controlling the radiation emitted by artificial night lighting is the great environmental challenge of our time. The purpose of sustainability is to sustain life, and such life cannot exist without the natural cycles of light that have driven the evolution of every animal on the planet. Artificial night lighting not only affects the physiology, sensory ecology, and activity partitioning of living organisms, these phenomena directly result in biodiversity loss and wide-scale extinction. Thus, the ecological importance of controlling light pollution cannot be overstated.

Sun-AM1-E-3

Detecting Spiny Dogfish in Gray Seal Diets

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Abstract - The western North Atlantic *Halichoerus grypus* (Gray Seal) population has been markedly increasing in recent years, shifting the interactions of marine food webs in which they are involved. Accurate information regarding Gray Seal diet is necessary to resolve unknown ecological impacts and evaluate the extent of seal–fishery interactions, but trophic overlap and methodological limitation complicate this assessment. In this study, *Squalus acanthias* (Spiny Dogfish) represents a prey item that occupies the same groundfish predator guild as Gray Seals, and that cannot be detected with traditional otolith analysis of Gray Seal scat. A single-species molecular scatology approach was developed utilizing the polymerase chain reaction (PCR), in which specificity to the target DNA was ensured and sensitivity of DNA detection was maximized. The technique was validated against known-diet scats collected from captive animals ($n = 10$ positive control, $n = 10$ negative control), with each conforming to expectations in 100% of samples. The method was then used to detect the presence of Spiny Dogfish DNA in a preliminary sample of wild Gray Seal scats ($n = 20$) collected from haul-outs in Maine and Massachusetts. With a detection threshold of 0.02 ng/ μ L, 2 scats were positively identified as containing Spiny Dogfish DNA. The calculated foraging rate in this study of Gray Seals on Spiny Dogfish (10%) suggests that Spiny Dogfish may relieve food limitation as an important population growth determinant of Gray Seals. An innovative and efficient molecular scatology technique was devised in this study for application to other prey species in future assays, and these preliminary findings advance understanding of ecological dynamics surrounding the New England Gray Seal population.

Sat-PM1-J-5

Distribution of *Plethodon cinereus* Color Morphs in Massachusetts: 40 Years Later

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Abstract - Global climate change is threatening species with habitat loss and extinction, but specific mechanisms driving changes in species abundance are unclear, partly due to lack of time-series data sets documenting population changes. In order to study these effects on amphibian species, we revisited Lotter and Scott's 1977 study of color morph frequency in relation to climate in *Plethodon cinereus* (Eastern Red-backed Salamander). 25 Massachusetts, New Hampshire, and Vermont localities were resampled, to quantify changes in morph frequency since 1977. At 19 of the 25 localities, we were able to find ≥ 100 salamanders, and of those 19, six localities had significant changes in morph frequency since 1977. Previous work suggests that the unstriped morph is more heat- and drought-tolerant, and thus should be the morph that increases in relative abundance over time in areas where global climate change results in either higher temperatures or decreased precipitation and more prolonged periods of drought or both. While we have not yet gathered local climate data for our sites over the period from 1977 to the present to discern any trends in temperature or moisture, we found a higher proportion of the unstriped morph at only 1 of the 6 localities with significant change; the others showed an increase in the striped or erythristic morphs. Lotter and Scott also suggested that there was differential mortality between striped and unstriped morphs, with unstriped morphs suffering higher juvenile mortality. We found no evidence of this pattern at 9 MA localities with age data, suggesting that the current frequency distribution is stable. We continue to work with collaborators to resample all 50 Lotter and Scott localities. Once all sites have been resampled, we plan to explore potential climate or land-use changes that may be driving changes in morph frequency.

Sun-PM2-E-5

Tracking Recovery of River Otter in Western NY since 2002 Using Sign Surveys and Occupancy Modelling.

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Abstract - Once widely distributed across North America, *Lontra canadensis* (River Otter) were extirpated by the mid-20th century from much of their historic range due to habitat loss, pollution, and over-trapping. Attempts to restore River Otter across NY state included the release of 279 otters from the Adirondacks to central and western NY between 1995 and 2000. Bridge-based sign surveys were established to track otter recovery with 159 sites visited once each winter of 2002–2015 and, at each site, 200 m of river bank was searched for otter sign. Otter were detected at only 50 sites over the 14-year period (98 total detections, with up to 11 detections at a given site). Our objectives were threefold: evaluate alternative means of survey replication (temporal versus spatial) so as to quantify the probability of site occupancy by otter, quantify otter population trends, and design an efficient statewide survey protocol to increase the efficiency and power of bridge-based surveys to detect future population changes. We pooled surveys across years to achieve temporal replicates, identifying 3 different “seasons” (2002–2005, 2006–2010, and 2011–2015) that minimized within-season and maximized among-season variation in the number of sites where otter were detected. Alternatively, over the last 3 years, we achieved spatial replication within a given year by establishing 44 blocks (16 km x 16 km in size) having 1–8 survey locations in each. Using either temporal or spatial replication, multi-season models indicated that the probability of site occupancy by otter increased with shoreline density and decreased with road density. Probability of otter detection and site colonization increased while probability of local extinction decreased over time, with an occupancy-derived estimate of population growth of $\lambda = 2.65$ between 2010 and 2011 and evidence of population stability thereafter. We conducted simulations based on these results to design a nearly statewide survey using the spatial replicate approach, involving 323 sample blocks and 2417 survey locations over an 84,025 km² area. We discuss the intention and design of these surveys, which are currently underway around the state, and will inform a statewide otter management plan.

Sun-PM2-D-2

Mapping the Invasive Vine Hardy Kiwi in Western Massachusetts

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Abstract - *Actinidia arguta* (Hardy Kiwi) is a climbing vine native to portions of Asia that has escaped from cultivation at multiple locations in the eastern United States. There is considerable debate as to the extent to which this species is invasive, demonstrating a tendency to spread into minimally managed natural or semi-natural areas (i.e., forests and forest edges), and outcompete existing vegetation, including trees. During 2015, the Massachusetts Division of Fisheries and Wildlife worked with partners, including the Town of Lenox, MA, and MassAudubon, to systematically map the spread of Hardy Kiwi in town-owned Kennedy Park and MassAudubon-owned Pleasant Valley Sanctuary. We established a 50 m by 50 m grid across a ~265-ha (~655-ac) area of the site and assigned each grid cell to a Hardy Kiwi cover class based on the extent of Hardy Kiwi present. Approximately 12.9% of cells (34.4 ha [85 ac]) contained a near monoculture of Hardy Kiwi, where most canopy trees had been toppled, and any remaining trees were covered with a high density of kiwi vine. Approximately 12.8% of cells (34.0 ha [84 ac]) exhibited patches of kiwi vine on the ground occupying >2.3 m² (25 ft²), and/or kiwi vines climbing into the canopy (without significant evidence of tree fall). Finally, in 13% (34.5 ha [85.2 ac]) of cells, one or more kiwi vines/seedlings were detected, occupying <2.3 m². The observed dominance of Hardy Kiwi in significant portions of the site and the extent of seedling spread in the understory support the conclusion that Hardy Kiwi can escape from cultivation, spread across forested landscapes, and cause significant damage to forested areas.

Sat-AM1-D-4

Using Ecological Utility to Define Native Plants

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Abstract - One of the least understood concepts in phytoecology is ecological utility in relationship to the definition of a native plant. Presently, native plants are domesticated, hybridized and otherwise altered without thought to the destruction this tampering does to ecological utility and hence ecosystems. By altering the chemical, physical and phenological properties of native plants “scientists” intent on “saving”, “improving” or commercializing these plants are creating non-native plants which can drive dependent species to extinction. The resultant cascade through an ecosystem can be catastrophic.

Sat-AM1-D-1

Two Small-scale Landscape Models of Invasive Plant Spread

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Abstract - In the past several years I have been studying two common ornamental flower genera; *Muscari* and *Galanthus*, as small-scale landscape models of invasive plant spread. Both spread slowly from their original planting, usually an abandoned homestead. *Muscari* is a hitchhiker which spreads along trails. Whereas, *Galanthus* is dependent on water flow/gravity for it to spread down a watershed. At Blue Marsh Lake in Berks County, PA *Muscari* has spread along two trails from its original homestead planting. *Galanthus* from a pair of sites at the Bordner Cabin, Swatara State Park, PA has spread down an ephemeral creek to its end and down a shallow delta shaped slope into a swamp. Both systems are slow and have some historical documentation to help with the timelines of spread.

Sat-PM2-D-1

Microplastic Pollution in Lake Champlain

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Abstract - Microplastic pollution in freshwater ecosystems is a topic that is starting to gain more widespread attention. Primary microplastics are designed to be small (e.g., microbeads, pre-production nurdles) and secondary microplastics result from photo and mechanical degradation. The origin of microplastics is marine debris and personal care products, whose small size evades wastewater treatment plant processing. Many organisms mistake microplastics for food and the particulates biomagnify up the food chain. There is growing concern that microplastic particulate has the potential to adsorb chemicals and pathogenic bacteria, leaching plasticizers up the food chain. We quantified and characterized microplastics derived from 24-hr samplings of wastewater treatment plant (WWTP) post-treatment effluent, as well as long-term monitoring (LTM) zooplankton samples from Lake Champlain. We assessed whether these particulate were biomagnifying within lake organisms. Wet peroxide oxidation was used to digest post-treatment WWTP effluent (Plattsburgh and Ticonderoga NY; St. Albans and Burlington, VT) in the Lake Champlain basin during 2015–2016. Across all sites, the dominant microplastics were characterized as fragments and fibers. Of samples processed, the fragment: fiber percentages have varied by plant, specifically Plattsburgh (51:23%), Ticonderoga (44:40%), St. Albans (67:8%), and Burlington (69:18%). Over 1000 microplastics were identified from a 24-hr sampling session, showing the potential of WWTP to be a significant source. Simultaneously, a total of 2265 LTM samples collected during 2010–2015 were processed. Pre-production rubber pellets (nurdles) were observed in samples from 2012 to 2015, with twice as many found in 2012–2013 as compared to 2014–2015, and microplastics were noted. Concern for the biomagnification of microplastics culminated in a trophic study. All organisms ($n = 411$) representing invertebrates ($n = 257$), 14 fish species ($n = 139$), and *Phalacrocorax auritus* (Double-crested Cormorants; $n = 15$) were processed in a manner similar to WWTP samples. Microplastic biomagnification was noted, and abundance varied across species. Average microplastic abundance in invertebrates, fish, and cormorants was 0.05, 1.91, and 22.93, respectively, and the majority were fibers. This research represents the first of its kind to quantify and map the microplastic pollution problem in Lake Champlain. Results from this study will inform wastewater treatment plant operators, land owners, fish and wildlife managers, lake stewards, and governmental officials of the threats microplastics pose to aquatic organisms.

Sat-AM1-C-3

Conservation and Constituency Engagement in an Urban Fire-dependent System

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Abstract – Inland *Pinus rigida* (Pitch Pine)–scrub oak barrens are globally rare pyrogenic ecosystems that support rich biodiversity. With fewer than 20 sites remaining, contemporary barrens represent an archipelago of unique young forest habitat islands in a sea of northeastern forest and human development. Managing these systems in urban landscapes to reduce wildfire risk and perpetuate fire-dependent biodiversity presents a unique set of biological and social challenges. In eastern NY, the 3300-acre Albany Pine Bush Preserve, a National Natural Landmark located between the cities of Albany and Schenectady, is using a constituency-centered approach to navigate these challenges. By combining multifaceted education and outreach strategies with a suite of land management tools, the Preserve is improving ecosystem viability and SGCN wildlife conservation, while reducing wildfire risk and recovering a metapopulation of the federally endangered *Lycaeides melissa samuelis* (Karner Blue Butterfly). This presentation will highlight the importance of biological and sociological sciences to effective conservation in urban landscapes.

Sun-AM2-E-4

Historical Occurrence and Uses of Pitch Pine in New England

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Abstract- *Pinus Rigida* (Pitch Pine) and *Quercus illicifolia* (Scrub Oak) were once a significant component of many of New England's sand plains due to relatively frequent fires. Pitch pine was used widely by early colonists for illumination and appropriately earned the names Candlewood and Torchwood. Turpentine was made from its sap. Pitch and tar produced from the pine in earthen kilns in the 1600s and early 1700s was vital for getting New England's ship building industry established. Tar production was called New England's first industry. The industry left very little evidence of its existence except in the names of places such as Tarkiln Hill Road, Tarkiln Path, Tarkiln Hill, and the villages of Tarkiln. Connecticut has lost an estimated 95% of its Pitch Pine/scrub forests due to development and displacement by other forest types that thrive in the absence of fire. It is now one of Connecticut's 13 state-listed imperiled ecosystems.

Sat-AM1-F-1

Video Documentation of the Predator Assemblage at Veery Nests in Northeastern Pennsylvania

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Abstract - The primary cause of nest failure for most songbirds is predation, yet it is often difficult to determine the actual predator involved because predation events are often quick and rarely observed. As a result, the actual assemblage of predators impacting a songbird population and the relative importance of individual predator species are rarely known. As part of a study of a *Catharus fuscescens* (Veery) population in Luzerne County, northeastern Pennsylvania, we used infrared, weatherproof video cameras connected to digital video recorders to study nest-predation events, 2014–2016. Each year, we placed video cameras at a sample of active nests allowing 24-hr monitoring of activity and viewed video to document interactions between Veeries and predators. Over 3 years, we monitored 67 Veery nests documenting 40 predation events involving 12 predator species (7 mammal, 4 bird, and 1 snake species). Most predation events (80%) occurred during day, with a peak in predation (28% of all events) during early morning (0530–0830). The most common predators during the day were *Tamiasciurus hudsonicus* (Red Squirrel; 7 events), *Tamias striatus* (Eastern Chipmunk; 6 events), and *Procyon lotor* (Raccoon; 4 events), whereas the most common predator at night was *Mustela frenata* (Long-tailed Weasel; 4 events). Predation events were about evenly split between nests with eggs versus young, although some predators appeared to favor nests with eggs, some favored nests with young, and some showed no preference. In 2 cases, we documented a predator killing an adult Veery at the nest, one by a weasel, the other by *Coluber constrictor* (Northern Racer). Based on our results, our Veery population is impacted by a wide variety of predators, with no single species dominating in importance.

Sun-AM2-D-1

The Effects of Human Encroachment On Shorebird Nests

Hans Gonzembach (Florida Shorebird Alliance; Hgonzembach@gmail.com; Newton Highlands, MA)

Abstract - Shorebirds in Florida have been declining due to habitat loss. As the human population and tourism grow on the shorelines, shorebirds are losing more nesting habitats to nurture the next generation. In response to loss of natural habitats, some shorebirds have started to nest on rooftops with gravel substrates. This is a special case of adaptive response observed among shorebirds. The species adapting to these changes currently are: Killdeer, Least Tern, Roseate Tern, and Black Skimmer. The Florida Shorebird Alliance (FSA) is a volunteer-based organization created by the Florida Wildlife Commission (FWC) to recruit volunteers from all across the state to monitor both rooftop nesting birds and beach-nesting birds that are on the “watch list” due to habitat loss. With the help of volunteers across the state submitting reliable data on nests, numbers of chicks, and species differentiation, FSA is able to focus on which species are stable, are in decline, doing well with rooftop nests, or need urgent protection. Apart from monitoring nests, and inputting data in the FWC website, volunteers have the opportunity to become stewards of their beach. When a pair of shorebirds are seen nesting or caring for young, the area is roped off, and volunteers will guard the area during the busiest times of the week to make sure no one gets too close to the nests and stress the birds out. With threatened shorebirds that nest in New England, such as Piping Plovers, we hope to bring the successful work that is being done in Florida up to the area. The FSA is still continuing data collection to this day. Based on data we have collected from 2014 to 2016, some species seemed to build their nests more often on rooftops as they lose nesting space on the beach. So, our research suggests a possibility of transition on nesting habitats of shorebirds from beaches to rooftops, a trend that might occur throughout the eastern coast. We suggest that shorebird monitoring programs in New England take this possibility into the account in future surveys and research.

Sat-PM1-E-3

Updates and Directions for Odonate Conservation in Massachusetts

Peter D. Hazelton (MassWildlife Natural Heritage & Endangered Species Program, Westborough, MA; peter.hazelton@state.ma.us) and Lynn C. Harper (MassWildlife Natural Heritage & Endangered Species Program, Westborough, MA; lynn.harper@state.ma.us)

Abstract - Currently, the Natural Heritage and Endangered Species Program (NHESP) lists 25 species of native Anisoptera and Zygoptera under the Massachusetts Endangered Species Act (MESA) based on species rarity, population trends, and identified threats to persistence. In recent years, reevaluation of the status of species within the Commonwealth, and regionally, has led to a focus on renewed survey effort and conservation assessment of species on the MESA list. This talk will present: (1) the status of the species currently listed under MESA in the context of the Regional Species of Greatest Conservation Concern (RSGCN), (2) updates on efforts to catalogue the NHESP collection of Odonate specimens, (3) efforts to monitor changes in occurrence of Anisoptera in a Western Massachusetts stream following flooding from Hurricane Irene and subsequent stream restoration project, and (4) the need for standard survey methods to evaluate and monitor the rarity and distribution for species listed in Massachusetts. With greater information on species status and trends within the region, conservation prioritization will be targeted at species listed as RSGCN and most critically in need of regulatory protection in Massachusetts under MESA.

Sun-AM2-J-4

Old Collections with New Uses: The Roles of Herbaria in the Anthropocene

Mason Heberling (Carnegie Museum of Natural History, Pittsburgh, PA and University of Tennessee, Knoxville, TN; heberlingm@carnegiemnh.org)

Abstract - For centuries, herbaria have served important scientific roles, most prominently for taxonomy, species identification, biodiversity documentation, and as repositories for voucher specimens. While these “primary” functions of herbaria remain relevant today, herbarium data have been increasingly used in unexpected, “non-traditional” ways in recent years. As such, herbaria as a collective institution can be thought of as an “exaptation”—that is, herbarium serve novel research functions which they were not initially intended (e.g., quantifying phenology shifts under climate change, extracting DNA for population genetics analyses, measuring post-introduction rapid evolution in invasive species, etc.). The term “exaptation” has largely fallen out of favor in the evolutionary literature in which it was introduced, but has been adopted in other research areas, especially referring to technological innovation. To understand trends on the uses of herbaria, I performed a systematic review of 11,586 abstracts from research papers published over the last century (1923–2016) that use or refer to herbarium data. I used automated content analysis, a machine-learning-based tool for the synthesis of big literature. The number of herbarium-related primary research publications have increased dramatically in the past 15 years. Despite decreases in institutional funding and rates of plant collecting, this publication trend for herbarium-related research is statistically similar to that of the plant sciences literature more generally, indicating the utility of herbarium data in research remain very strong. Herbarium-related research continues to be largely focused on taxonomically related concepts but has increasingly shifted to include new topics, particularly relating to molecular systematics, genetics, and the use of historic and recent specimens to quantify the effects of human-induced environmental change. Considering these relatively new uses of herbarium data, a new conceptual framework could highlight the methodological/analytical issues that must be considered, advance herbarium-based studies in an era of global change, and stimulate a broader discussion on emerging new curation needs as these novel functions of herbaria become more prevalent.

Sat-PM1-C-2

Potamogetonaceae Hybrids of Northeastern United States

C. Barre Hellquist (Massachusetts College of Liberal Arts, Emeritus, North Adams, MA; c.barre.hellquist@mcla.edu) and C. Eric Hellquist (State University of New York Oswego, Oswego, NY; eric.hellquist@oswego.edu)

Abstract - The family Potamogetonaceae consist of two common genera: *Potamogeton* and *Stuckenia*. Worldwide there are ~70 species with over 100 hybrids. In the Northeast, there are about 30 taxa with 26 known hybrids occurring between many of the species. *Potamogeton gramineus* and *P. zosteriformis* are one parent species in numerous hybrids. Some crosses are morphologically easy to identify while others require DNA analysis.

Sat-PM1-F-4

Forty Years of Change in the Vascular Aquatic Flora of Ossipee Lake, NH

C. Eric Hellquist (State University of New York Oswego, Oswego, NY; eric.hellquist@oswego.edu) and C. Barre Hellquist (Massachusetts College of Liberal Arts, North Adams, MA; c.barre.hellquist@mcla.edu)

Abstract - Ossipee Lake (Carroll County, NH) is the sixth largest lake entirely within the State of New Hampshire and has a 19,260-ha watershed. The watershed contains several critical habitats including rare beach-strand communities found along Ossipee Lake. Ossipee Lake (1251 ha) consists of the main basin, plus 3 additional basins (Broad Bay, Leavitt Bay, and Berry Bay). The lake is oligotrophic with an alkalinity of ~6.5 mg/l and a pH of ~6.6–6.8. From 1968 to 1971, the aquatic flora of Ossipee Lake was surveyed by the second author. In 2012, we resurveyed the lake focused on the emergent, submersed, and floating vascular plants of Ossipee Lake including its bays and inlets. In the past 40 years, the immediate watershed of Ossipee Lake has been exposed to increasing human pressures as development and recreational use of the lake has increased. Our goal was to revisit sites from the 1971 study and better understand how succession of aquatic plants has changed since then. A total of 102 species were collected from 41 collection sites during the 2012 survey. Eleven species found in the original survey were not relocated and 23 new species and 4 hybrids were found since 1971. Four state-listed species (*Bidens beckii* [Water Marigold], *Potamogeton gemmiparus* [Budding Pondweed], *P. vaseyi* [Vasey's Pondweed] and *Utricularia resupinata* [Resupinate Bladderwort]) were found in 2012, but not 1971. Three invasive species not found in the original survey were also found: *Callitriche stagnalis* (Pond Water-Starwort), *Lythrum salicaria* (Purple Loosestrife), and *Myriophyllum heterophyllum* (Variable Watermilfoil). Five confirmed hybrid taxa in the Potamogetonaceae and Typhaceae also were located. Eleven species were found previously, but were not located in 2012. The loss of several species appears linked to the erosion of peatmats along parts of the lake shoreline and increased human disturbance related to recreational use. This study illustrates the importance of having voucher specimens to validate observations of ecological succession.

Sat-PM1-F-2

White-nose Syndrome: The Future of Some Severely Affected Bat Species

Carl Herzog (New York State Department of Environmental Conservation, Albany NY; carl.herzog@dec.ny.gov)

Abstract - White-nose syndrome is a fungal disease that has resulted in extensive mortality of hibernating bats in eastern North America. The severity of its impact at the population level varies greatly by species. For some species the impact has changed over time. Virtually all *Myotis lucifugus* (Little Brown Bat) in NY contract the disease, but typical fungal loads and severity of infection have decreased in recent years and survival has increased, apparently as a result. There is some evidence that recovery is underway, although contradictory data also exist. Some similar but less compelling data exist for *Perimyotis subflavus* (Tri-colored Bat). Most, but notably not all, populations of *Myotis septentrionalis* (Northern Long-eared Bat) and *Myotis sodalis* (Indiana Bat) in NY are likely still in continuous decline.

Sat-PM2-E-2

Lakes and Ponds of the Worcester Plateau Ecoregion: Patterns of Aquatic Plant Diversity and Species Distribution

Matthew G. Hickler (Botanist and Ecologist, Royalston, MA; mhickler@hughes.net)

Abstract - Aquatic plant surveys of 25 randomly selected lakes and ponds in the Worcester Plateau Ecoregion of Massachusetts, along with a suite of environmental and site variables, were used to explore patterns of species-richness and species distribution among ponds. Patterns were, for the most part, poorly predicted by environmental variables. Watershed area was positively correlated with pond-richness. Development in the shoreline zone was positively correlated with species-richness in ponds at low-to-moderate levels and negatively so at higher levels. The presence of regionally uncommon species was correlated with Ca/Mg hardness. Man-made and natural ponds were found to have equivalent biological values with respect to diversity (both Alpha and Beta), presence of regionally uncommon species, and occurrences of State-listed rare species. However, several species with affinities for either natural or artificial ponds were identified. Over all, the Beta component of diversity (i.e., differences in species composition between ponds) drives regional diversity. A substantial decline in regional aquatic plant diversity is predicted if the current trend in dam loss (both from natural attrition and planned removals) continues.

Sat-PM1-F-3

Hemlocks, Horticulture, History, and HWA: Exploring the Introduction of the Hemlock Woolly Adelgid into the Eastern US

Patrick Horan (Saving Hemlocks, Sapphire, NC; phoran@uga.edu)

Abstract - Nathan Havill and associates have conducted DNA analyses to conclusively identify the “lineage” of *Adelges tsugae* (Hemlock Woolly Adelgid [HWA]) introduced to the Eastern US, as originating in Southern Japan. This presentation will use historical and biological information to explore both the timing and mode of this introduction. An inquiry into the “Japanese Garden” movement in the early 20th-century US, as pursued at selected “Gilded Age” Estates, suggests that the introduction of HWA may have occurred 40 years earlier than the official 1951 USDA discovery, which occurred in Richmond, VA, on the grounds of the Maymont Estate. This presentation will explore evidence for this hypothesized historical event, as well as the possibility that other prominent estate gardens may also have contributed to the introduction of HWA into the eastern US.

Sun-AM2-F-1

Ectomycorrhizal Fungi from Resistant Spore Banks Support Post-Fire Pines

Thomas R. Horton (SUNY-ESF, Syracuse, NY; trhorton@esf.edu)

Abstract - *Pinus* spp. (pine) cannot survive without ectomycorrhizal (EM) fungi, and in fire-adapted communities, only a subset of their typical symbiotic fungi support pine establishment after a major fire. I will present data documenting the response of EM fungi to fire from my work in pine forests in California and Oregon. I will focus on studies in *Pinus muricata* (Bishop Pine) communities where the mature trees were killed in a wildfire, and a new cohort of pine established following seed released from serotinous cones. Pine root tips in undisturbed forest communities were by a rich community of EM fungi including species of *Russula*, *Lactarius*, *Thelephora*, *Tomentella*, *Boletus*, *Amanita*, *Tricholoma*, and *Cortinarius*. However, the mycelial networks of these fungi do not survive catastrophic fire events that kill their hosts. Instead, a different group of EM fungi dominated by species of *Suillus* and *Rhizopogon* colonize post-fire seedlings. These fungi produce a dormant spore bank analogous to a soil seed bank. They thrive in disturbed areas where mycelial networks of more complex communities are reduced or absent. The belowground dynamic we observed in Western forests is evident in fire-adapted pine communities in Northeastern forests. We are using these lessons to enhance efforts to restore *Pinus rigida* (Pitch Pine) at the Albany Pine Bush Preserve.

Sun-AM2-E-1

Assessment of Metal Concentrations in *Lythrum salicaria* (Purple Loosestrife) at Three Rhode Island Sites Using ICP-MS Analysis Techniques

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Abstract - Due to its persistence in damaged environments, *Lythrum salicaria* (Purple Loosestrife), described as an invasive plant species in the northeastern US, and often the target of eradication efforts by ecosystem managers, has been evaluated for its potential to uptake toxic metals from the environment and in so doing help to mitigate contamination. In this study, inductively coupled plasma mass spectrometry (ICP-MS) was used to analyze metal levels, including Zn, Mg, Ca, Cr, Ni, Mn, Cu, As, Se, Ag, Cd, Ba, and Pb, in soils and plant tissues samples taken from 3 Rhode Island sites with large stands of *L. salicaria*. The purposes of the study included establishing base levels for metals using ICP-MS analysis, examining the relative distribution of metals in the plant tissues, assessing the levels for metals in soils at the same sites, and comparing these observations to previously published data gathered by alternative methods. The concentration of metals within plant tissues varied by tissue type (e.g., Zn, Mg, and Ca were higher in the leaves, while Cr was observed to be higher in the roots). Results also showed that for some metals, levels were higher in plant tissues than in surrounding soil samples (e.g. Ca, Zn, and Cr). These variations could be linked to the physiology of the plant, or due to environmental influences. Although none of the metal levels exceeded soil and plant regulatory standards at these study sites, it is possible that at other more contaminated sites with significant ambient toxic metal contamination, the propensity of *L. salicaria* to grow in dense stands might enable this plant to effectively uptake specific contaminants, and thereby have some potential for phytoremediation. At the very least, ecosystem parameters should become part of the site assessment procedure for *L. salicaria* prior to eradication efforts. Future studies will examine the capability of the plant for uptake of selected metals in controlled laboratory studies, as well as expanding environmental sampling from areas known to have metal contamination that are also observed to have thriving populations of *L. salicaria*.

Sun-PM2-F-2

On the Trail of Bobcats: Tracking and Camera Traps to Study *Lynx rufus*

Dallas Huggins (Great Bay Community College, Portsmouth, NH; dhuggins639@students.ccsnh.edu) and **Eric Aldrich** (Marketing Specialist, The Nature Conservancy; ealdrich@tnc.org)

Abstract - Field surveys are an invaluable part of wildlife research, from supplying data and research samples, to promoting conservation, informing and engaging the community, and better understanding population dynamics and wildlife behavior. Two New Hampshire naturalists have led two years of field research on local *Lynx rufus* (Bobcat) populations in part of Hillsborough County, NH, in collaboration with the Harris Center for Conservation Education. Expanding on studies by the University of New Hampshire and the New Hampshire Fish and Game Department on Bobcat population dynamics, their research focuses in on an area of southwestern New Hampshire that has a long legacy of land protection and excellent habitat. Field investigations, coupled with tracking and camera-trapping protocols, assist in identifying core areas, travel corridors, and denning sites. Continued monitoring can improve understanding of Bobcat behavior and habitat use, which can in turn advance land protection goals and improve public understanding of this top predator's role in the ecosystem.

Sun-PM2-D-1

Prioritizing Odonata for Conservation Action in the Northeastern US

Pamela Hunt (NH Audubon, Concord, NH; phunt@nhaudubon.org), Erin White (New York Natural Heritage Program, Albany, NY; elwhit02@esf.edu), Matthew Schlesinger (New York Natural Heritage Program, Albany, NY, mdschles@esf.edu), Jeffrey Corser (New York Natural Heritage Program, Albany, NY; jdcors@esf.edu), and Phillip deMaynadier (Maine Department of Inland Fisheries and Wildlife, Bangor, ME; phillip.demaynadier@maine.gov)

Abstract - Odonates are valuable biological indicators of freshwater ecosystem integrity and climate change, and northeastern North America (Virginia to Maine) is both a hotspot of odonate diversity and a region of historical and growing threats to freshwater ecosystems. This highlights the urgency of developing a comprehensive conservation assessment of the Northeast's 228 resident odonate species. Here, we offer a prioritization framework modified from NatureServe's methodology for assessing conservation status ranks by assigning a single, regional vulnerability metric (R-rank) reflecting each species' degree of relative extinction risk in the northeastern US. We calculated the R-rank based on 3 rarity factors (range extent, area of occupancy, and habitat specificity), 1 threat factor (vulnerability of occupied habitats), and 1 trend factor (relative change in range size). We combine this R-rank with the degree of endemism (% of the species' US and Canada range within the Northeast) as a proxy for regional responsibility, thereby deriving a list of species of combined vulnerability and regional management responsibility. Overall, 18% of our region's odonate fauna is imperiled (R1 and R2) and peatlands, low-gradient streams and seeps, high-gradient headwaters, and larger rivers that harbor a disproportionate number of these species should be considered as priority habitat types for conservation. We suggest that a working group be formed to develop a comprehensive conservation plan for northeastern Odonata, and we anticipate our analysis will help guide and standardize conservation assessments at the statewide level in the Northeast.

Sun-AM2-J-1

Identifying Regional Species of Greatest Conservation Need

Pamela Hunt (NH Audubon, Concord, NH; phunt@nhaudubon.org), Elizabeth Crisfield (Strategic Stewardship Initiative; elizabeth@ssinitiative.com), Karen Terwilliger (Terwilliger Consulting; ktci@verizon.net), Phillip DeMaynadier (Maine Department of Inland Fisheries and Wildlife, Bangor, ME; phillip.demaynadier@maine.gov), and Catherine Haffner (Pennsylvania Game Commission, Harrisburg, PA; chaffner@pa.gov)

Abstract - The Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTTC) has worked collaboratively to conserve imperiled species since the 1980s. In 1999, the first formal published assessment reviewed 106 species based on factors including risk, data deficiency, geographic range, and other special cases. In 2013, a more comprehensive review was completed considering regional responsibility and regional concern, based on 2005 Wildlife Action Plan SGCN lists. In 2016, the NEFWDTTC undertook an update considering all 2957 Species of Greatest Conservation Need from 2015 State Wildlife Action Plans in the 13 states and District Columbia as candidates for the Regional Species of Greatest Conservation Need (RSGCN) list. In general, RSGCN are imperiled, data deficient, or stronghold species for which the region has a responsibility to conserve populations. This presentation explains the method for selecting RSGCN and presents the results of the intensive expert review process.

Sun-PM2-C-5

Using Herbarium Specimens to Document Phenological Change in Central New York Woodland Plants

Robert Jarvis (State University of New York Oswego, Oswego, NY; rjarvis@oswego.edu) and **C. Eric Hellquist** (State University of New York Oswego, Oswego, NY; eric.hellquist@oswego.edu)

Abstract - As climate warms, regional herbaria are becoming a valuable source of phenological data for understanding how earlier springs may be affecting the timing of blossoming. The Herbarium at the State University of New York at Oswego has approximately 50,000 specimens collected primarily from central New York and other upstate counties. This collection had been in storage for decades and represents a time capsule of collections. The collection has specimens going back to the 1830s, but the majority of the collection is concentrated from the 1930s to the 1970s. Records since the 1980s are scarce. We recorded label data from ~400 specimens of 10 species of the spring flora of Central New York. Herbarium records from Cayuga, Cortland, Madison, Oneida, Onondaga, Oswego, and Tompkins counties were included in our analyses. We recorded the Julian date of flowering specimens for 7 focal species: *Anemone acutiloba* (Sharp-lobe Hepatica), *Arisaema triphyllum* (Jack in the Pulpit), *Cardamine concatenata* (Toothwort), *Cardamine diphylla* (Crinkleroot), *Caulophyllum thalictroides* (Blue Cohosh), *Trillium grandiflorum* (White Trillium), and *Erythronium americanum* (Yellow Trout Lily). Regression analyses indicate that all species except for *C. diphylla* are flowering earlier over time for the 40 years of specimen collections ($P < 0.05$). The trends in our data from the 1930s to 1970s reflect similar studies that indicate spring wildflowers have been flowering earlier in the growing season in response to warming regional temperatures.

Sat-PM1-C-3

The Natural History of Woody Plant Flowers

Jerry Jenkins (Wildlife Conservation Society Adirondack Program, Northern Forest Atlas; jcjenkins@hughes.net)

Abstract - The Northern Forest (NF) contains ~100 genera of woody plants. All but 9 have flowers. Because no synopsis of their floral diversity and ecology seems to exist, I created one, using databases and graphical techniques developed for the Northern Forest Atlas. The questions were simple: How diverse are the NF flowers? How long ago did they evolve? How well does flower structure predict pollination? and How are flower types and pollination syndromes distributed over habitats? The results are partly expected and partly novel. Forest canopies are, in fact, dominantly wind-pollinated. Many NF genera are quite old, and the order of their appearance in North America is not related to their evolutionary history. Insect pollination is numerically more common than wind pollination overall; over three quarters of the genera and species are insect pollinated. So bees and flies matter, as they have for over 60 million years. Advanced flowers are more common than basal ones and more likely to show reduction than elaboration. So efficiency also matters. Overall, woody plant evolution has been more about getting rid of things than adding them.

Sun-AM1-D-3

Visualizing Rare Plant Habitats

Jerry Jenkins (Wildlife Conservation Society Adirondack Program, Northern Forest Atlas; jcjenkins@hughes.net)

Abstract - Rare plants have special needs, and their habitats have special features. Some of these are structural. Many others, including many that at first appear structural, are dynamic. The structural requirements of rare species are treated poorly in the literature. The dynamic requirements are rarely treated at all. I am developing visualizations—combinations of photographs and diagrams—that show the structure and dynamics of about 40 habitats in the Northern Forest region (NFR). My hope is that they will be of practical use for finding rare species and theoretical use as a model of how habitats work. I present 3 visualizations here: a stony berm on the north Atlantic coast, a marble ledge in Vermont, and an ice-scoured shore in the Adirondacks. The habitats are different, but the processes in them are similar. This perspective interests me because it suggests that the NFR has a small set of core processes from which it generates a large number of habitats. Please stay tuned.

Sun-AM2-C-1

Evaluating the Accuracy of Camera Trapping Methods for Open Populations of White-tailed Deer

Christopher Johnson (Pace University, Pleasantville, NY; cj09109p@pace.edu), Gabriel Miranda Diaz (Science Research Mentoring Program, American Museum of Natural History, NY), Shakifur Bhuiyan (Science Research Mentoring Program, American Museum of Natural History, NY), and Mark Weckel (American Museum of Natural History, NY; mweckel@amnh.org)

Abstract - Infrared-triggered camera surveys have become a popular means of monitoring wildlife populations. We evaluated the accuracy of this method versus front-looking infrared (FLIR) aerial surveys in monitoring open populations of *Odocoileus virginianus* (White-tailed Deer). We ran a ground-based camera survey on the Greenbelt Nature Sanctuary (GNS; Staten Island, NY) and Teatown Lake Reservation (TLR; Ossining, NY) concurrent with an aerial survey. We analyzed the camera data using an individual branch-antlered-male method and estimated abundance using a capture-recapture (CR) and spatially explicit capture-recapture (SECR) framework. Densities were calculated using transect coverage and mean maximum distance moved (MMDM). Our aerial survey found 110 deer in the GNS survey area and 147 within the TLR survey area. CR abundance estimates were 135.9 (119.8–157.8) for the TLR. Density of organisms was found to be similar between the 2 methods for the TLR; the estimated survey area was 17.5 sq km, the aerial survey found 8.37 individuals per sq km whereas CR found 7.69 (6.78–8.94) individuals per sq km.

Sat-AM2-C-2

Old-growth Forests and Streams, and Managing Forests for Old-growth Characteristics

William S. Keeton (University of Vermont, Burlington, VT; william.keeton@uvm.edu)

Abstract - [not yet submitted]

Sat-PM2-F-2

Multiscale Effects of Landscape Heterogeneity and Fragmentation on Edge-nesting Birds in Northern MA

Gregory S. Keller (Gordon College, Wenham, MA; greg.keller@gordon.edu), Catherine Schweitzer (Gordon College, Wenham, MA, catherine.schweitzer@gordon.edu), Joshua Spoonhour (Gordon College, Wenham, MA, josh.spoonhour@gordon.edu), Cher Chow (Gordon College, Wenham, MA, cher.chow@gordon.edu), and Lauren Purdy (Gordon College, Wenham, MA)

Abstract - Habitat fragmentation has both obvious and subtle impacts on populations of breeding songbirds. With fragmentation, the relative proportion of edge habitat increases and can drastically change the composition of bird communities. Little is known about how edge composition from fragmentation affects breeding birds compared to natural landscape heterogeneity, particularly from vegetation, habitat, and landscape scales. In addition, impacts more subtle than species composition, such as singing rate, are often overlooked in multi-scale research. We compared fragmented sites (pasture and residential forest edges) to natural heterogeneity (wetland edges) to determine the effects of habitat on species composition and breeding behavior (i.e., singing by territorial males). We studied 8 focal species that are typically associated with edges to see how they responds to these 3 habitat categories at 36 study sites during the 2015–2016 breeding seasons. Four of our 8 focal species were more abundant in natural edges than in pasture or residential edges, whereas the other species exhibited no difference in habitat use. In addition, 3 species were negatively affected by landscape-level fragmentation, whereas 2 species were positively affected. Furthermore, *Geothlypis trichas* (Common Yellowthroat) exhibited a correlation between its singing rate and the amount of natural edge, supporting our prediction that behavior is affected by fragmentation and heterogeneity differently. Research will continue during the 2017 field season to elucidate additional significant patterns that may affect conservation of these species.

Sun-PM2-C-2

Controlling Deer and Beech: Testing the Effectiveness of Fencing, Herbicide, and Mechanical Treatments in Patch Cuts of Northern Hardwood Forest, Gilsum, NH

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Abstract - A growing body of research suggests that the high densities of *Odocoileus virginianus* (White-tailed Deer) directly affect the composition and success of forest regeneration. This 3-year study was conducted to examine and compare the effect of deer exclosures and *Fagus* (beech)-control treatments on forest regeneration growth in a northern hardwood forest. We established research plots in 6 patch-cuts 0.4–0.7 ha (1–1.5 acres) in size in the spring of 2014 in Gilsum, NH. Three of the 6 patch cuts were randomly selected along with an adjacent forested area of similar size and enclosed by 2.4-m (8-ft) high fencing to exclude deer. Within the patches and forested area, 3 treatments were applied to beech regeneration. The 3 treatments were: control (no change), a one-time foliar application of chemical herbicides, and a one-time mechanical cutting using loppers and brush saws. Our results indicate that that fencing is an incredibly effective tool that allows rapid growth of regenerating woody species where impacts from deer browse inhibit growth. Seedlings grew significantly taller, and seedling diversity was greater in fenced patches (within the control treatment). Both mechanical and chemical treatments were effective at reducing average height and abundance of *Fagus grandifolia* (American Beech), thereby allowing regeneration of pioneer species. The herbicide treatment seemed to have a suppression effect on height, density, and species richness. It is clear from this study and others that a high density of White-tailed Deer has a significant impact on the height and composition of forest regeneration. Where management of deer populations continues to be a challenge, it becomes important to explore other strategies to maintain a healthy forest system. In areas with high pressure from deer browse, we recommend fencing for at least 3 to 5 years, until seedling height exceeds the risk of severe damage by deer browse. We recommend mechanically removing beech in place of chemical treatment.

Sat-AM2-C-3

Flora and Vegetation of an Industrial Area in the New Jersey Meadowlands

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Abstract - There have been few studies of the flora and plant assemblages of tidal wetlands in urban and industrial areas in the US, although such information is important for decisions about conservation and restoration. We studied 445 ha of estuarine wetlands and wetland edges associated with Berry's Creek in the New Jersey Meadowlands. From August to October 2015, we conducted a total of 165 timed searches (samples) at 68 sites, ranking each vascular species by cover. Habitats were mostly brackish tidal marsh and wetland fill with some topographic variation related to past disturbances and filling practices. We recorded 216 plants identified to species and 41 additional plants identified only to genus or family in samples. Qualitative observations revealed another 52 species. Of the 268 species identified, 149 (56%), were native to New Jersey; the rest were nonnative species (113), or species of indeterminate origin (6). The high number of native species in the flora may reflect the diversity of habitats and availability of native species from the surrounding area, despite the highly urbanized and industrial environment. Nonetheless, several nonnative plants were abundant or dominant. Several regionally rare or state-rare species were present, although the 2 rarest (*Taxus canadensis* [Canadian Yew] and *Quercus macrocarpa* [Bur Oak]) probably spread from plantings. Nonmetric multidimensional scaling indicated vectors of elevation, tree dominance, and species richness, opposite to a "wetness" index. Nontidal and less-brackish tidal wetlands were dominated by *Phragmites australis* (Common Reed), mostly in extensive stands, with the most-brackish wetlands dominated by either *Phragmites* or small patches of *Spartina* spp. (cordgrasses). The tidal marsh flora lacked a few saltmarsh species typical of the northeastern US, and the tidal marsh vegetation, extensively dominated by *Phragmites*, resembled many urban tidal marshes. Vegetation on fill appeared similar to that of other altered industrial areas. The proportion of nonnative species was similar to that of other US urban areas.

Sat-AM1-C-2

Post-glacial Colonization Path of the Blacknose Dace into Northeastern North America

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Abstract - Post-glacial colonization is well researched in the field of phylogeography. Deglaciation in New England began only ~20,000 years ago, representing a very recent (geologically and evolutionarily speaking) starting point for recolonization of flora and fauna into communities that we consider native today. However, a large gap exists for studies of post-glacial colonization of flora and fauna in the Northeast region of the United States and adjacent Canada. To this end, we have been conducting a phylogeographic study of *Rhinichthys atratulus* (Eastern Blacknose Dace). This study starts to fill this void by examining the phylogeographic patterns of *R. atratulus* populations from Virginia, USA, to Nova Scotia, Canada. By collecting this data, we aimed to answer the question of which glacial refugium or refugia were responsible for harboring the populations of *R. atratulus* that recolonized the northern parts of its current distribution. Phylogenetic analyses of 2 mitochondrial genes and 9 microsatellites reveal that *R. atratulus* recolonized northern regions from multiple refugia. There are 2 dominant haplotypes that are geographically separate. These data indicate refugia were likely in Pennsylvania and New Jersey, supporting the Pleistocene refugia theory that southeastern regions harbored populations close to the glacial maximum during the last ice age. We also conclude that the rivers in the state of Connecticut served as a gateway to the eastern post-glacial recolonization. We theorize that *R. atratulus* dispersed through the temporary glacial river in Long Island Sound before it was inundated by seawater. This study begins to reveal the complex colonization history of fishes in New England.

Sat-AM2-F-1

Foraging Behavior of Migrant Passerines in Urban Parks

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Abstract - City parks often become oases for migrating passerines. As such, they attract a disproportionate number of birds and present unique opportunities for the observation and study of bird behavior. As part of a larger study on the use of urban microparks by migrating passerines, I have been able to make detailed observations on the foraging behavior of various taxa during migration. Some clear patterns have emerged. Migrating warblers typically forage in a small area, cycling through it repeatedly over the course of the day in a 20–30 minute time frame. The size of the area fluctuates apparently with food availability, but the time cycle remains constant. In contrast, vireos tend to forage linearly, working their way through a park over the course of the day at a speed consistent with insect densities. Finches and sparrows are sedentary in contrast to the insectivores. Such a difference is not necessarily a predictable outcome of feeding on seeds and buds as opposed to insects but does seem to be demonstrable, especially during the fall migration. Overall, the insights gathered into the behavior of migrating birds in this study may be useful in managing resources in urban parks to improve their usefulness to birds during a time of significant stress.

Sun-AM2-D-4

Monitoring Eastern Spadefoot in New England: Design and Early Results of the Massachusetts Plan

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Abstract - *Scaphiopus holbrookii* (Eastern Spadefoot) is widely considered the most secretive and elusive amphibian in New England. Spending most of its life underground and emerging only periodically to feed or, on rare occasion, to breed, the species is notoriously difficult to study. Those seeking to observe Eastern Spadefoot have traditionally relied on the strategy of waiting for breeding events to venture out in hopes of discovering undocumented populations and/or determining statuses of known populations via calling surveys or tadpole surveys. However, breeding activity is extremely brief and populations do not breed every year, presenting major challenges for managers, regulators, researchers, and others seeking information to benefit conservation of this regionally imperiled species. The Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries and Wildlife has developed a 5-year, statewide monitoring plan for Eastern Spadefoot, relying in part on information gleaned from recent research in southern New England. The plan utilizes an adaptive, quasi-citizen science approach and implements a 3-pronged strategy for predicting spadefoot emergences (i.e., for breeding, dispersal, or feeding). In its first year of adoption in 2016—a drought year with almost no breeding activity—the plan and its participants produced a wealth of low-cost data having important management and regulatory implications. Data obtained in 2016 and during the next several years will be used to help inform a variety of management decisions and actions, including experimental population introductions.

Sat-PM1-D-2

Habitat Destruction by Elephants? Questionable Assumptions in Wildlife Management

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Abstract - In many parts of Africa, *Loxodonta africana* (African Elephant) are in danger of becoming locally extinct due to ivory poaching. Paradoxically, there are other areas where the elephant population has reached high enough density that they are blamed for harming biodiversity by destroying rare trees, and “invading” human settlements. In these cases, wildlife managers resort to killing, moving, translocating, or contracepting breeding groups of elephants to reduce population numbers. However, we have evidence these breeding herds have little to no unsustainable effect on regional biodiversity or plant communities. In over 3 years of almost daily direct observations of the feeding behavior of elephant breeding herds, we recorded no instances of them destroying mature rare trees. That suggests elephant bulls, who live apart from breeding herds, are the culprits. Questioning the assumptions behind management strategies and targeting conservation efforts to the animals actually affecting the environment has obvious broad implications, in both Africa and the northeastern US. Moreover, trans-boundary conservation in African Savannah is comparable to landscape-scale ecoregion-wide conservation efforts in northeastern US (for instance, the “two-country one-forest” concept across the northern Appalachian Acadian ecoregion). Thus, there is great potential for information and knowledge sharing between research in NE US and the African Savannah ecosystems. In addition, research on elephant ecology and conservation can be a very effective teaching tool in formal conservation education and informal public awareness on biodiversity conservation in North America.

Sat-PM1-E-4

A New Morphological Discovery Sheds Light on the Difficult Management of the Invasive *Cabomba caroliniana* (Carolina Fanwort) in New England Freshwater Ecosystems

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Abstract - Native to parts of South America and southeastern United States, *Cabomba caroliniana* (Carolina Fanwort) is an invasive aquatic pondweed species that has migrated to northern regions of the United States. The plant is known for its rapid growth pattern and its ability to dominate freshwater ecosystems by forming dense mats beneath the surface of the water. The overgrowth of this invasive plant is difficult to manage, with few effective eradication/control methods available. A multidisciplinary study has been carried out on *C. caroliniana* sampled from 3 freshwater lakes in Rhode Island and Massachusetts to comprehensively understand the biology, ecology, and management of this invasive plant in New England. Scanning electron microscopy (SEM) examination of *C. caroliniana* leaves from all 3 lakes revealed an abundance of unicellular trichomes (hairs) on the adaxial leaf surface, which may be responsible for the secretion of a sticky mucus (or gelatinous slime). More interestingly, the trichomes are readily shed, with their protruding circular bases remaining on the leaf surface, creating a rough texture for the leaves which we believe helps the leaves to stick or hook to each other or to other surfaces, thus forming extensive mats and adding to the persistence and easy dispersal of this invasive plant in spite of aggressive management approaches.

Sun-PM2-F-3

***Phragmites*: A Troubling Invader for Some but Important Resources for Others**

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Abstract - The genus *Phragmites* is a cosmopolitan grass with a wide distribution covering a range from tropical to cold temperate zones of both the Northern and Southern Hemispheres. The plants can tolerate a wide range of hydrological and salinity conditions, allowing them to occupy various habitats ranging from salty coastal wetlands to freshwater wetlands to arid and saline areas. New England has been suffering from the increasing invasion of non-native *Phragmites* strains introduced from Eurasia for at least a century. These problematic “invaders” are, however, highly welcomed in semideserts and deserts as they are ideal pioneer plants for vegetation restorations in those areas, such as in Northwest China. Field expeditions to the arid areas in Gansu Province and Xinjiang Province in the summers of 2011 and 2016 observed the ecological contribution of *Phragmites* to prevent desertification and enhance vegetation restoration in Northwest China. *Phragmites* plants can also be economically beneficial as their above ground parts can provide a source of fiber, their rhizomes have medicinal uses, and the plants can also be used for soil retention and water purification. *Phragmites* played an important role in the past along the ancient Silk Roads in Asia. The ancient Great Wall in Northwest China built during the Han Dynasty (206 BC to 220 AD) was mainly constructed with soil and *Phragmites* culms and leaves. When the prospect of controlling the invasion of *Phragmites* plants seems challenging and expensive, considering using them as an economic resource may provide an alternative and promising resolution.

Sun-PM2-F-1

Histopathology of Trematode (Digenea) Infections in Freshwater Snails (Gastropoda, Pleuroceridae) from Rice Creek, NY

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Abstract - North America contains 703 species of freshwater snails (Gastropoda) in 16 families, but 74% of this biodiversity is imperiled or extinct. Population declines may be due to physical changes to habitats, contaminants, and or competition with introduced species. However, the potential role of metazoan parasites is poorly understood. To that end, we are conducting a comparative histopathological study of trematodes infecting freshwater snails in Rice Creek (Lake Ontario tributary), NY. We collected by hand while snorkeling and identified in the lab (to the lowest taxonomic class we were able) a total of 130 snails of 4 species representing Pleuroceridae, which we refer to as sp. 1 ($n = 56$), sp. 2 ($n = 40$), sp. 3 ($n = 20$), and sp. 4 ($n = 14$) from collections made in June and July 2015. Cercariae were obtained through shedding, heat-killed at 60 °C, and fixed in 10% formalin. A tissue sample from each snail, and a subset of 20 cercariae were fixed in 95% ethanol for DNA sequencing. We observed 4 trematode species based on cercaria morphology, which were refer to as cr. 1 (monostome), cr. 2 (leucochloridium or mutabile), cr. 3 (vivax), and cr. 4 (haplospalchnid). Among the sampled snails, prevalence ranges are as follows: cr. 1 = 0–64%, cr. 2 = 0–5%, cr. 3 = 3 0–3%, and cr. 4 = 7–25%. However, prevalence of each infection is likely higher as we sometimes observed underdeveloped trematodes in histological sections. Among infected snails, gonads typically appeared to be replaced by sporocysts or redia, and cercaria with the exception of an occasional focus of reduced or compressed testicular or ovarian acini. While morphological differences between trematode species were apparent, damage associated with each trematode species was histologically similar, and cellular responses to infections were not observed.

Sun-AM1-C-2

Anthropogenic Drivers of Space Use among Coyote, Gray Fox, and Fisher on Fort Drum Military Installation, New York

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Abstract - Food and cover resources fundamentally drive the distribution and abundance of species, but competition is also likely to play an important role, especially among mammalian carnivores. Moreover, carnivores vary in their tolerance for (and by) humans, and human activities may vary the outcome of competitive interactions. Consequently, understanding the mechanisms by which carnivores might exploit human-dominated systems is critical to mitigating human-wildlife conflict and maintaining functional ecosystems in increasingly urbanized landscapes. The goal of this research is to understand the drivers of spatial distribution among *Canis latrans* (Coyote), *Urocyon cinereoargenteus* (Gray Fox), and *Martes pennanti* (Fisher) across a gradient of urban to wild forest conditions, focusing on the effects of human disturbance, anthropogenic food, and built infrastructure on site occupancy and co-occupancy by these species. Using a conditional two-species occupancy model on detection-non detection data collected using camera traps, we investigated the co-occupancy patterns of the species while accounting for imperfect detection and site characteristics. We deployed a total of 30 and 71 camera traps between May to September in 2015 and 2016, respectively. Species use of each camera location was detected within 5-day capture intervals. Coyotes were nearly ubiquitous within the study area across a wide range of human disturbance. Coyote occupancy showed a quadratic relationship with distance to road and was highest at intermediate distance from the nearest road. Gray Foxes and Fishers had more restricted distribution compared to Coyotes. Gray Fox occupancy was higher in human-dominated areas, and this species made use of culverts for dens and escape cover. Fisher occupancy was higher in predominately forested areas and areas with intermediate density of roads. Ongoing analyses will quantify the strength of interaction between species and the effects of competition on use of human-dominated landscape features.

Sun-PM2-D-3

Odonata in Eastern Massachusetts Exhibit Phenological Shifts Predicted by a Warming Climate

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Abstract - A resurvey of Odonata at Ponkapoag Pond (Norfolk County, MA) was conducted in 2015 and 2016, with results compared to data collected 1966–1971. Mean April–August temperatures at the site have increased between 1966 and 2016 at a rate of 0.29 °C per decade (± 0.06 SE, $P < 0.001$). An earlier emergence of adult odonates was the predicted response to the increased flight-season temperatures, as well as a longer flight period for more southern species. Resurvey results support these predictions, showing a significant shift toward an earlier average first flight date for the 43 species compared ($P < 0.001$) and an increase in the average flight period. Additionally, the magnitude of individual species' phenological shifts show a significant correlation to the median latitude of each species' range. This project represents only the second resurvey of Odonata in the Americas and furthers the growing understanding of how warming climates are affecting biodiversity.

Sun-AM2-J-3

Distribution and Status of the Endemic American Grey Soil Worm, *Eisenoides lönnbergi*, in the Northeast

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Abstract - *Eisenoides lönnbergi* (American Grey Soil Worm) is one of just a few native species that are found north of the most recent glacial maximum. This earthworm has been widely collected in the coastal mid-Atlantic region, but only infrequently in the Northeast. Unlike most earthworm species, *E. lönnbergi* is commonly found in saturated soils. We sampled earthworms from wetlands in Upstate New York and compiled records of *E. lönnbergi* to better describe the distribution and habitat associations of this species in the Northeast. We found *E. lönnbergi* at 14 of 22 sampled sites, including 8 of 14 riparian areas and 6 of 8 wetlands of other types (bogs, fens, and swamps). Soil pH at colonized sites ranged from 3.4 to 8.5 units. At the 3 most acidic sites, *E. lönnbergi* was the only species detected by our sampling. Published records also support an association between *E. lönnbergi* and wetland habitats of variable pH. We suggest that *E. lönnbergi* is not uncommon in portions of New York State, but has been largely ignored because of its association with wetlands. Because of its habitat associations, *E. lönnbergi* is vulnerable to anthropogenic processes that threaten wetlands.

Sun-AM1-F-3

Nacrezation of *Unionicola* sp. (Acari: Unionicolidae), and Metacercariae (Digenea) in *Elliptio complanata* (Bivalvia: Unionidae) from Oquaga Creek, New York

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Abstract - Pearls may form in bivalve mollusks when inorganic particles become lodged between the nacre and mantle. Nacrezation may also occur in response to injuries associated with parasites including larvae of Digenea (flukes), Cestoidea (tapeworms), and Acari (mites). In contrast to marine bivalves, parasite nacrezation has been seldom documented from Unionoida (freshwater mussels). While investigating histopathological changes to tissues of *Elliptio complanata* (Eastern Elliptio), Unionidae, associated with eggs of *Unionicola*, Acari, and metacercariae of Digenea, we observed pearls in tissue and blister pearls on the nacre. Mussels were collected from Oquaga Creek, NY, in July 2014 ($n = 28$) and May ($n = 20$), June ($n = 20$), and July ($n = 21$) 2015. From the total sample, we observed pearls embedded in the mantle and gill of 12 mussels (prevalence = 13.4%), and blister pearls from 53 individuals (prevalence = 59.5%). Mite eggs were embedded in the middle mantle of 60 mussels (prevalence = 67.4%), typically in clusters. Metacercariae infected 39 mussels (prevalence = 43.8%), usually in the mantle edge. Blister pearls were usually minute (<1 mm in diameter), ovoid, and occurred individually or in clusters. Interestingly, we observed mite larvae embedded in the nacre of 8 mussels. Pearls were usually opaque, and the nucleus obscured. We will attempt to dissolve the pearls using an acidic solution to determine whether mites or metacercariae are enclosed. Eggs and larvae of *Unionicola* spp. may have been the most common cause of blister pearl formation because they infected a larger area of the mantle than metacercariae, and because we frequently observed encapsulation responses to cuticular remnants of mites. By comparing infected and uninfected mantle tissues using specialized histological staining techniques such as Dahl's method for calcium, we hope to shed light on how parasites may induce pearl formation.

Sun-AM1-C-1

The Effect of Weather Conditions on Common (*Sterna hirundo*) and Arctic (*Sterna paradisaea*) Terns Foraging Patterns

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Abstract - *Sterna hirundo* (Common Tern) and *Sterna paradisaea* (Arctic Tern) were tagged with small radiotags to track their movements from Petit Manan Island, a small tern colony off the coast of Maine. We used mixed effects linear modeling with individual and day as random effects in order to determine which of the weather and oceanographic conditions impacted the number of, length, and directionality of foraging trips of the tern species. ANOVAs were also completed to determine the difference in the number of and length of foraging trips between the 2 species of terns as well as between the different categories of reproductive status. Two chi-square contingency tables were completed to compare the difference in the directionality of the foraging trips between the two species of terns as well as the different categories of reproductive status. The length, directionality, and number of foraging trips were impacted by temperature, cloud cover, wind, sea-surface temperature, presence of chicks, visibility, thunderstorms, and species. There was a significant difference in the length of foraging trips between the 2 species of terns, with Common Terns having longer trips. There was also a significant difference in the length of foraging trips between the categories of reproductive status. The number of trips per day made by the each species of tern was significantly different from one another. The directionality of the foraging trips was also significantly different between the 2 species. Lastly, the directionality of the foraging trips was significantly different between the different categories of reproductive status. We propose that the various weather and oceanographic conditions forced the terns to remain at the colony for longer periods of time in order to protect their young from the elements. Researching the potential impacts of weather conditions on seabirds is an important topic as climate change is predicted to increase the frequency and intensity of storms. Determining which aspects of weather impacts terns will assist managers with how to address climate change in future conservation decisions.

Sun-AM2-D-2

Epiphytic Bryophyte and Lichen Communities of Old-Growth Adirondack Northern Hardwood Forests

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Abstract - Observational studies of epiphytic bryophytes and lichens have revealed unique communities that characterize large, old hardwood trees in Adirondack forests. While these communities are better established in old-growth forests, they do occur in disturbed and managed stands when large, old residual trees are present, and the presence of lichen and bryophyte mats may have important implications for other arboreal organisms.

Sat-PM2-F-4

Conservation Genetic and Genomic Tools to Inform Management Decisions for New England Cottontail

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Abstract - *Sylvilagus transitionalis* (New England Cottontail) is a species of conservation concern and the focus of a multi-agency and institutional effort to conserve the species. Region wide, New England Cottontails are restricted to 4 main geographic populations in New England and eastern New York. The drastic decline in the distribution of New England Cottontail precipitated the establishment of a captive breeding program in 2011 at the Roger Williams Park Zoo in Providence, RI, which was subsequently expanded in 2015 to include the Queens Zoo in Corona, NY. In 2012, a captive breeding population was initiated on Patience Island in the upper Narragansett Bay of RI. The Wildlife Genetics and Ecology Laboratory has developed and implemented a variety of genetic and genomic tools to inform New England Cottontail management decisions during multiple stages of their conservation program. A mitochondrial DNA barcode was developed to ensure reliable identification of the species of origin of DNA extracted from fecal samples. Microsatellite markers have been used to identify individuals and estimate the size of the New England Cottontail population on Patience Island. That estimate indicated a sufficient number of individuals to allow for the translocation of a cohort of animals to the mainland. In 2016, 20 New England Cottontail from Patience Island along with 33 captive-born animals were released at Great Swamp Management Area in West Kingston, RI, in an effort to establish a new population. Microsatellite and genomic markers have been used to test for potential hybridization between New England Cottontail and non-native *S. floridanus* (Eastern Cottontail). No evidence of hybridization between cottontail species has been detected. Genomic tools also have been used to determine New England Cottontail conservation units. Population genomic analyses have re-confirmed the pattern of 4 geographic populations, and analysis of adaptive genetic variation is being used to identify conservation units. The results of our research will help inform management decisions for both captive and wild New England Cottontail. The continued integration of genetic and genomic tools will be critical to support the recovery of New England Cottontail.

Sat-AM2-F-2

New England Terrestrial Water Bears

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Abstract - Water bears (Phylum Tardigrada) are minute animals closely related to arthropods. Terrestrial tardigrades occur in leaf litter, soil, and cryptogams, where they are renowned for their ability to enter a state of cryptobiosis. The terrestrial tardigrade fauna of New England is poorly known. There are a few published records from Maine, Vermont, New Hampshire, Connecticut, and Massachusetts, and none from Rhode Island. Nineteen species have been reported, mostly from Maine and Vermont. Some of these belong to cosmopolitan species complexes and were identified before the development of current standards of taxonomic rigor. We have collected samples of moss and lichen from sites in Connecticut, Massachusetts, Maine, New Hampshire, and Rhode Island. So far we have found 8 species in the Connecticut material, 2 in Massachusetts, 6 in Maine, 10 in New Hampshire, and 6 in Rhode Island. Seven of these species are new records for New England. *Milnesium bohleberi*, a species hitherto found only in North and South Carolina, was collected in Connecticut. Also present in the same sample was an undescribed species of *Milnesium*. Specimens collected in New Hampshire include *Milnesium granulatum*, a species known from Europe and North Carolina. It has recently been demonstrated that in some species of *Milnesium* the claw configuration (i.e., the number of spurs on a claw) changes, with newly hatched individuals having fewer basal claw spurs than adults. However, in the New Hampshire species even the smallest individuals have the [3-3]-[3-3] configuration. *Milnesium* eggs are laid in the molted exoskeleton of the mother. By allowing some eggs to hatch and comparing the claw configuration of the neonates to that of the mother's exoskeleton, we verified that claw configuration in this species does not change with age.

Sat-PM1-J-1

Wildlife Biologists and Rehabilitators: Moving from Conflict Towards Collaboration

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Abstract - Wildlife biologists and rehabilitators often see sick and injured wildlife from different perspectives. Natural mortality, predator/prey/scavenger relationships, survival of the fittest, and development of natural disease resistance often conflict with the goal of the rehabilitator to care for and repatriate a sick, injured, or orphaned animal. Because of this, researchers and wildlife biologists often regard the role of the wildlife rehabilitator as being of little importance, if not detrimental, to natural wildlife populations and communities. Many rehabilitators, on the other hand, have invested substantial effort and resources into rescuing wildlife for the purpose of returning them to the wild with the belief that they are making a positive difference. Is there common ground? Some of the areas of concern include release locations, possible disease introduction, use of antibiotics in wildlife, outdated state regulations regarding rehabilitation, the need for education on the biology of the species being rehabilitated, and the value of individuals to the populations. Currently some rehabilitators are making significant contributions to wildlife research by documenting information such as snake fungal disease progression and treatment and post-release survival of wildlife following severe injury or illness. There are increasing opportunities for wildlife biologists and rehabilitators to partner for the benefit of wildlife.

Sun-PM2-C-3

Using Silviculture to Perpetuate Pitch Pine Communities in Connecticut

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Abstract- *Pinus Rigida* (Pitch Pine) is not sustaining itself under current natural conditions in much of New England. Historically, severe fire often opened the semi-serotinous cones of the pines, created a favorable seedbed and killed overtopping trees, allowing the shade-intolerant pine to germinate, grow vigorously and become part of the overstory. Silvicultural practices such as commercial timber harvesting, light firewood thinnings, and prescribed burns are used to regenerate Pitch Pine in Connecticut.

Sat-AM1-F-4

A Feathery Tale of Close Encounters: Mosquitoes, Birds, and Human Health

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Abstract - The global spread of exotic mosquito vectors and emergence of arboviruses pose profound risks to human health and creates serious challenges for public health agencies. Detailed knowledge of the vector–host–pathogen interactions is essential for evaluating vectorial capacity in mosquitoes as well as assessing the role of individual vertebrates as reservoir hosts involved in maintenance and amplification of arboviruses. The vector–host interactions involving mosquitoes, the role of avian hosts as superspreaders of the arboviruses, and the potential influence of population structure in host interactions of mosquito species will be discussed.

Sun-PM2-J-1

State of the Bats in Connecticut

Katherine Moran (Wildlife Biologist, Connecticut Department of Energy and Environmental Protection, Wildlife Division, Sessions Woods WMA, Burlington, CT; kate.moran@ct.gov)

Abstract - Connecticut has 9 different species of bats, 8 of which are listed under the Connecticut Endangered Species Act. Three migratory tree-roosting bats are of special concern, while all but one cave-hibernating bat are listed as endangered. White-nose syndrome (WNS), first documented in Connecticut in 2008, is responsible for dramatic declines in cave-hibernating bats in the United States and Canada. The Connecticut Department of Energy and Environmental Protection's Wildlife Division monitors bat populations by conducting hibernaculum surveys, maternity colony counts, and acoustic surveys. Although there are limitations, and the data require interpretation by trained biologists, advances in acoustic technology have made it possible to collect much more data than traditional methods on both cave- and tree-roosting bats across a wide geographic area. In addition to monitoring bat populations, the Wildlife Division is involved in a range of conservation efforts including technical assistance, outreach, bat box installations, and cave-gating projects. Thanks to the numerous volunteers, homeowners, rehabilitators, land trusts, and the caving community, the Wildlife Division has greatly expanded its understanding of bat populations in the state, including documenting the first physical specimen of *Myotis leibii* (Eastern Small-footed Bat) in 70 years.

Sat-PM2-E-1

Disentangling the Complex Fire History of Maine

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Abstract - Using tree-ring-dated fire-scar occurrences from 64 *Pinus resinosa* (Red Pine) stumps and snags, we developed high-resolution temporal data to describe some of Maine's fire regimes. This fire record is based on 143 dated fire scars from 6 study sites. Single-tree scar-based fire intervals ranged from 4 to over 149 years at 5 of the study locations. Sites varied in mean composite fire intervals from 12 to 38 years. Differences in local relief and landform among sites (eskers, bog edges, forest, and lake shores), the temporal-spatial distribution of fire scars among trees, and tree recruitment dates indicated that surface fires, patchy fire events, and stand replacement fires all occurred. In some forests, stand replacement was indicated by synchronized forest age, dates of recruitment, and tree death. The distribution of fire intervals varied by study site and represented a bimodal fire frequency that varied between 20 and >100 years. Early mean composite fire intervals in the study areas (each ~1.5 km²) varied from 8.3 to 104 years between the years 1700 and 1934. The movement of Native Americans and early Europeans and settlers in this area probably played a major role in determining the temporal variability of ignitions and temporal changes in fire intervals. Like many fire regimes in eastern North America with uncommon lightning fires, fire-regime changes are due to complex topography, temporal changes in human populations, and climate. A previously published physical chemistry fire model (PC2FM) predicted a 24.7-year mean fire interval (MFI) compared with 21.3-year MFI empirically derived from this study, indicating that fires are more frequent than predicted from climate alone.

Sun-AM2-E-2

Sharing Hidden Treasures: Digitization of Original Archival Materials Mounted on Herbarium Specimens

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Abstract - Herbarium sheets in many herbaria bear original archival materials, most often letters and photographs. Because they are inextricably and unpredictably linked to individual botanical specimens, these archival materials are unknown to archivists and most botanists. Furthermore, current specimen-digitization protocols mostly ignore these sources, leaving the archival materials largely inaccessible. However, these archival materials comprise a rich body of information about many topics, especially handwriting, interpersonal relationships, human history, human culture, species biology and frequency, habitat characterization, biological conservation, the environment, and collection-event details. In order to realize the potential of these materials as information sources, we propose modifications to current workflows, resulting in digitization of archival materials concurrently with specimens. These modifications are relatively minor and uncomplicated. On average, performing additional steps to digitize the archival materials adds only seconds to the specimen digitization process, but captures and makes available a wealth of additional information. Insights on the past from these archival materials provide critical input for work in the 21st century and beyond.

Sat-PM1-C-4

Conservation of Hudson River Intertidal Plants: Current Status, Threats, and Recommendations

Robert Naczi (New York Botanical Garden, Bronx, NY; rmaczi@nybg.org)

Abstract - The southern portion of New York's Hudson River encompasses a major estuary that extends 150 miles from the mouth of the river at the southern tip of Manhattan, north to the Federal Dam at Troy. This estuary provides multiple habitats for many vascular plant species. From a conservation perspective, the most important are species that are restricted or nearly restricted to intertidal habitats, those areas that fall between low and high tides. Intertidal plants provide food and shelter for wildlife, stabilize shorelines, and buffer adjacent uplands from the effects of storm surges. Intertidal plants are by nature rare because their habitats are quite limited in extent. Additionally, these species are important because most occur only in eastern North America, with several globally rare. Review of historic herbarium and literature records indicates 32 vascular plant species as restricted or nearly restricted to intertidal habitats in the Hudson Estuary. Extensive fieldwork over the course of 4 years has revealed 6 (19%) of the species to be secure, 21 (65%) imperiled, and 5 (16%) extirpated. Several of the imperiled species are present in very low numbers and are vulnerable to extirpation. Intertidal plants face several serious threats to their survival, including pollution from excess nutrients, competition from invasive species, and habitat destruction, especially from wave action resulting from shipping. Management and restoration strategies that are likely to be the most effective in conserving intertidal plants would be (1) reduction in amount of raw sewage dumped in the river; (2) active management of the invasive plant species with the greatest impacts on intertidal plants, *Phragmites australis* (Eurasian Reed; Poaceae) and *Trapa natans* (Water Chestnut; Lythraceae); and (3) restoration of side channels and coves with gradually sloping shores.

Sat-PM1-F-1

The Future of Wildlife Forensic Education: Connecting the Needs of Working Labs with Research Students

R. Christopher O'Brien (University of New Haven, West Haven, CT; rcobrien@newhaven.edu)

Abstract - Wildlife forensic science is unique in that it spans so many different disciplines, but that also makes doing relevant research difficult. Students often face a daunting task of deciding what research to conduct and how it will be applied to the field, whereas research labs are in dire need of research being conducted on cases that they are working on or see on a regular basis. A high priority is a new way to connect the students looking to do forensic research with the labs that have plenty of such work waiting to be done. The Society for Wildlife Forensic Sciences is addressing this need with a new program that takes the focus beyond the individual university level and brings it to an international stage. This talk will discuss the future of wildlife forensic research and how we can use students to assist working labs and their needs.

Sat-AM2-F-3

Lessons Learned from Teaching Acoustics

Kathleen O'Connor (Environmental Resources Management, Syracuse, NY; kathleen.oconnor@erm.com)

Abstract - In recent years, acoustic monitoring has increased in use as a survey technique to monitor bats. The survey method allows for passive sampling of bats, which has a number of benefits, including less disturbance to individuals and the sampling of broader areas. The introduction of user-friendly bat detectors and automated software programs has also encouraged the use of this survey tool in the field. In light of this increased use of acoustic surveys, we at Environmental Resources Management (ERM) have offered several training courses on the various aspects of acoustic monitoring and analysis. While acoustic sampling has many benefits, it is a complex subject, including many nuances that are not immediately obvious to novice practitioners. Furthermore, the field continues to develop at a rapid pace, with regular updates to current automated software call-identification programs and modifications to US Fish and Wildlife Service Guidance. Keeping up with the current science can be challenging, but the first step is to know what questions to ask and how to evaluate changes critically. As instructors, we've also learned a great deal from these courses, including specific challenges that bat biologists face and how to address continued uncertainties in the science with practical solutions.

Sat-PM2-E-4

Wetland Plant Succession in a Restored Floodplain

Matthew R. Opdyke (Point Park University, Pittsburgh, PA; mopdyke@pointpark.edu)

Abstract - The restoration of floodplains provides vital ecosystem services such as flood protection and habitat and food for wildlife. A seven-year study of wetland plants was conducted on 20 acres of a restored floodplain in southwestern Pennsylvania. Prior to restoration, which began in 2009, the floodplain was managed as a golf course. Planting native saplings and shrubs to enhance the diversity of plants was an initial priority in the restoration. Temporal and spatial changes in the plant community was studied by monitoring the abundance and diversity of herbaceous plants, shrubs, and saplings in permanent sampling plots and conducting growth measurements of sapling indicator species. The abundance and diversity of forb and graminoid communities at the site have been impacted by changes in floodplain hydrology and competition for resources against invasive species. Forbs account for 54% of all herbaceous plants, with *Lysimachia nummularia* (Creeping Jenny) and *Lythrum salicaria* (Purple Loosestrife) making up 70% of the forbs. These dominant plants are both invasive species, which negatively impact the potential diversity of plants and are poor sources of food for wildlife. Invasive species at the site have increased from 2010 to 2016, from 26% of all herbaceous plants to 48%, respectively. Regardless of efforts to control the invasive species, their persistence continues to threaten the conservation status of the floodplain. The graminoid community is dominated by *Leersia oryzoides* (Rice Cutgrass), *Phalaris arundinacea* (Reed Canarygrass), *Carex vulpinoidea* (Fox Sedge), and *Carex tribuloides* (Blunt Broom Sedge). Although these plants are native to Pennsylvania, Reed Canarygrass is an aggressive competitor for space, further inhibiting plant diversity in the floodplain. The dominant sapling species are *Ulmus americana* (American Elm), *Acer negundo* (Boxelder), and *Populus deltoides* (Eastern Cottonwood), which account for 55% of all shrubs and saplings. Succession has been recorded among saplings, with Boxelder beginning to be replaced by later-successional species. In conclusion, long-term studies are central for monitoring native communities and studying the impacts of invasive species. Understanding the factors that affect restoration and succession are critical in conservation applications.

Sat-AM1-C-1

Third-Order Fire Effects: The Value of The Long View in Ecology

William A. Patterson III (UMass, Amherst, MA; wap@eco.umass.edu)

Abstract - Across 5 decades, I have examined initially first- and second-order effects, and more recently third-order effects of logging and fire on terrestrial and aquatic ecosystems at Itasca State Park in northwestern Minnesota. On an 81-ha treatment area, second-growth *Populus* spp. (aspen) stands were clearcut with slash broadcast burned during 1973–1975 to restore primeval *Pinus* spp. (pine) forests cut during 1902–1917. A sediment core from Ozawindib Lake, into which the treatment area drains, documents the vegetation and fire history of the watershed since ca. 800 BP. Until 1900, the landscape was burned with increasing frequency. Silt layers in the sediments coincide with increases in charcoal and variations in pine pollen abundance, suggesting that post-fire, surface-soil erosion facilitated pine regeneration prior to early logging. Slash-fueled fires burned until 1923, but no silt layers occurred after the early 20th-century disturbances. Sampling of forests, streams, and wetlands documented the response to the 1970s-era treatments. Cutting and burning stimulated aspen to reproduce vegetatively, but pine seedlings did not establish. Sediment loads in streams increased after burning, but no surface-soil erosion occurred. Lake morphology and productivity were not affected. Remotely sensed imagery from 1975 thru 2013 documents increased *Castor canadensis* (North American Beaver) activity, including new dams and ponds, and then catastrophic failure of dams leading to severe channel and riparian erosion. A 2016 site visit revealed upland vegetation similar to that before 1970s-era treatments, but with a large erosion fan in the lake downstream from the treatment area. I postulate that aspen regeneration stimulated increased Beaver populations. Late 20th-century rain storms caused new dams to fail resulting in erosion of stream channels. That similar events occurred prior to but not at the start of the 20th century may be explained by Beaver extirpation due to trapping ca. 1650–1850. Populations did not recover until mid-20th century. Forest tree species as well as Beaver-trapping history are similar across the Lake States to New England suggesting that—in similar landscapes—such third-order effects of landscape-scale disturbances are possible throughout the region.

Sun-AM2-E-3

Windstorm and Salvage Harvest in Northern Mixed Deciduous Forests Change Forest Structure, but Not Plant Community Diversity or Richness

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Abstract - Windstorms are the most important ecological disturbance in northeastern United States forests due to their frequency and intensity, and the severity of tree destruction they cause. In the wake of a windstorm that damages forest stands, managers decide whether or not to salvage harvest (logging damaged trees to recover economic, recreational, aesthetic, or other values threatened by the destruction of existing forest conditions); however, outcomes of post-windstorm salvage harvest in northern mixed deciduous forests are not well understood. We investigated impacts of a 2010 windstorm and subsequent salvage harvest in Vermont on forest structure and plant community. Data collected in 2014 indicates that forest structure was significantly different among stands that were not windthrown or recently harvested (control), unharvested windthrown stands (windthrown), and salvage-harvested windthrown stands (salvaged). Control and salvaged sites had significantly lower coarse woody debris abundance than windthrown sites; there was no difference in coarse woody debris abundance between control and harvested sites. Live tree basal area was significantly higher in control sites than both windthrown and salvaged sites. We found no significant differences in dead tree basal area between control sites and windthrown or salvaged sites, although dead tree basal area was lower in salvaged sites than windthrown sites with marginal significance. Plant community diversity, calculated as Shannon-Wiener diversity indices, and species richness were not different among treatments, although some individual plant species were favored by disturbance. These findings provide forest managers with clear evidence of short-term outcomes of post-windstorm salvage harvest in mixed deciduous forests.

Sun-AM2-C-3

The Distribution of Marine Tardigrades in the Intertidal Zone of Allen Island, Maine

Emma S. Perry (Unity College, Unity, MA; eperry@unity.edu)

Abstract - Two species of marine tardigrade in the genus *Echiniscoides* were found living on the barnacle *Semibalanus balanoides* (L.) in the intertidal zone around Allen Island, ME. *Echiniscoides sigismundi sigismundi* is found on intertidal shores throughout Maine whereas *E. wyethi* has to date only been found around Allen Island. Barnacles were sampled over 3 consecutive years to determine the intertidal distribution of both *Echiniscoides* spp., to determine if both species were always found in all intertidal zones and to determine habitat selection of each species. DCA analysis indicated the 2 species of *Echiniscoides* were most abundant in different intertidal zones and also displayed different geographic preferences.

Sat-PM1-J-2

Changes in Flowering Phenology Over 125 Years in the Central Appalachians

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Abstract - Spring ephemerals in the Central Appalachians are a key component of deciduous forest communities and indicators of shifting phenology due to climate changes in this ecosystem. The objectives of this study were to determine if there have been any changes in date of flowering for 2 species of spring ephemerals in West Virginia over the last 125 years, to determine which climatic factors affect the blooming date of these wildflowers, and to evaluate the effect of elevation on changing blooming dates using herbarium specimens and photographs. *Cardamine concatenata* (Cutleaf-toothwort) and *Erythronium americanum* (Yellow Troutlily) have both significantly advanced their spring flowering over the last century (mean = 1.01 days/decade), and spring temperature was the strongest predictor of blooming date (2.91 and 3.57 days earlier/1 °C increase in spring temperature, respectively). Flowers at <500 m elevation bloomed earlier and demonstrated a stronger shift in flowering date over time than flowers at >1000 m elevations. Lower elevations, higher spring temperatures, higher winter temperatures, and low amounts of precipitation were associated with earlier spring flowering. This research demonstrates the plasticity of phenological response to a variety of climatic variables, the usefulness of using herbarium specimens to reconstruct flowering dates over a topographically variable area, and the contrasting effects of climate change on high elevation regions of West Virginia.

Sat-AM1-D-3

Effects of Functional-Group Richness of Plants on Invertebrate Diversity in Wetlands

Lindsey A. Pett (SUNY Plattsburgh, Plattsburgh, NY; lpett003@plattsburgh.edu) and Rachel Schultz (University of Wisconsin-Stevens Point, Stevens Point, WI; Rachel.Schultz@uwsp.edu)

Abstract - Diversity of plant functional groups is often more important than species diversity in regards to the overall functioning of an ecosystem, but little work has been done to investigate the role of plant functional group diversity on invertebrate diversity. We hypothesized that an increase in functional group diversity and a lower C:N ratio in vegetation would increase invertebrate species richness. We also hypothesized that, due to complementarity among species, mixtures of functional groups would produce more biomass and store more nutrients than that of monocultures. We planted wetland mesocosms with 3 functional groups represented by 2 species each: rushes (*Juncus effusus* and *Eleocharis palustris*), tussocks (*Scirpus cyperinus* and *Carex stricta*), and ferns (*Onoclea sensibilis* and *Osmunda cinnamomea*). These species are native New York State plants that represent a range of morphological traits above and belowground. We found a positive relationship between plant functional-group richness and invertebrate species richness. We found that C:N ratio was 14% lower in mesocosms with 3 functional groups present compared to monocultures. Aboveground biomass was marginally greater when functional group richness increased. We found aboveground biomass to be 18% greater in 2015 and 32% greater in 2016 in the highest diversity treatment versus the functional-group monocultures. We found no correlation between functional-group richness and nutrient storage. Although we didn't find a significant influence of functional group diversity on nutrient cycling, there was a significant influence on invertebrate diversity, giving evidence to the functionality of plants influencing invertebrate diversity rather than nutrient content.

Sun-AM2-C-2

Neotropical Riverweeds (Podostemaceae): Confusing Taxonomy Obscures Extinction Threats

C. Thomas Philbrick (WCSU, Danbury CT; philbrickt@wcsu.edu) and Paula K.B. Philbrick (UConn-Waterbury; Waterbury, CT; paula.philbrick@uconn.edu)

Abstract - Taxonomic understanding is crucial in conservation as species are generally the unit of interest. When a reliable taxonomy does not exist, conservation efforts can be compromised, e.g., resources focused on taxonomic artifact are wasted. Neotropical members of the angiosperm plant family Podostemaceae (riverweeds) show pertinent examples of the importance of taxonomy in conservation. Species in this family occur only attached to rocks in swift currents of rivers. Factors involving an unusual life cycle, morphological variation in plant form, poor collections, and logistic difficulties associated with the habitat have all contributed to a taxonomy that remains unusable in much of the family. Even preconceived notions of what features species in this family "should" possess could confound development of reliable taxonomies. This talk will address how basic elements of traditional taxonomy (field work, herbarium study) provide insight into recognition of species, estimates of species diversity, and species endemism. Two decades of field study has led to the discovery of many new species, but these have been offset by the synonymizing of previously recognized species. Thus, taxonomic work has led to an overall reduction in the number of species recognized in the family. The second element of this talk will address how taxonomic clarity helps demonstrate that threats of species extinction in neotropical riverweeds are real. The number of neotropical species that occur only in a single river is estimated to be as high as 37%. Examples from representative genera will be discussed. Arguably the most widespread threat to riverweeds is construction of hydroelectric dams. Large dams create reservoirs upstream and long stretches of managed water flow downstream, both of which degrade or destroy habitat for riverweeds. The impact of a single dam can span hundreds of kilometers. Effective management confronts confounding economic, social, and political issues that reflect the complex array of factors impacting tropical rivers. Though specific conservation concerns in neotropical riverweeds are coming into focus, effective management solutions are not.

Sat-PM1-E-2

Using Historical Data and eDNA Surveys to Rapidly Evaluate Hellbender Population Decline

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Abstract - Evidence suggests *Cryptobranchus alleganiensis* (Hellbender) are undergoing population declines throughout large portions of their range. More-complete data are needed for determining the extent and cause(s) of population declines and extirpations. Integrating newer survey techniques and freely available data with traditional fieldwork may allow for effective, rapid assessment of population decline. The resulting data can be used to create holistic models for assessing variables that may cause or serve as predictors of population declines and extirpations. We used detailed historical species records and environmental DNA (eDNA) survey methods to identify changes in population distribution of the *Cryptobranchus alleganiensis alleganiensis* (Eastern Hellbender) in the Susquehanna River drainage of Pennsylvania. We measured water quality and substrate composition at each sampling site. We used freely available, high-resolution (1 m) remote sensing imagery to evaluate canopy cover at the watershed and stream-reach scales. We evaluated both recent and historic canopy cover along the stream reach to account for potential legacy effects associated with historical land use. We used logistic regression with Bayesian inference and AICc model selection to determine which variables were most important for predicting Hellbender population persistence and extirpation. Hellbenders persisted in only 42% of the 24 historical record sites. The best-fit model indicated conductivity was the strongest predictor of Hellbender population persistence and extirpation. Hellbender populations persisted in streams with conductivity values less than 278 $\mu\text{S}/\text{cm}$, but conductivity of sampling sites ranged up to 757.6 $\mu\text{S}/\text{cm}$. Conductivity was strongly negatively correlated with canopy cover within the total watershed ($r = -0.83$) and the riparian buffer of the watershed ($r = -0.77$). Increased conductivity, which is related to ionic composition of the water and tends to increase following deforestation, may inhibit sperm motility and thus limit recruitment of Hellbenders and other aquatic vertebrate species with external fertilization. By integrating historical data, eDNA survey techniques, field-collected data, and high-resolution remote sensing data, our study design allowed for rapid assessment of predictors of and changes in Hellbender distribution over a relatively broad geographic area. This cost- and time-effective approach may be appropriate for evaluating other elusive and rare aquatic species.

Sun-PM2-E-3

Predicting the Presence/Absence of Eurasian Watermilfoil and Variable Leaf Milfoil in Adirondack Waters Using Freely Accessible GIS Data

Sean A. Regalado (Adirondack Watershed Institute, Paul Smith's College, Paul Smiths, NY; sregalado@s.paulsmiths.edu) and **Daniel L. Kelting** (Adirondack Watershed Institute, Paul Smith's College, Paul Smiths, NY; dkelting@paulsmiths.edu)

Abstract - Predicting the distribution of invasive species outside their known distribution is necessary for cost-effective early detection and management. *Myriophyllum spicatum* (Eurasian Watermilfoil [EWM]) and *Myriophyllum heterophyllum* (Variable Leaf Milfoil [VLM]) are economically and environmentally costly invasive species in North America, yet little has been done to quantitatively model the risk of VLM or EWM invasion for lakes with no water chemistry data. Using multiple logistic regression (MLR) and classification trees we modeled the presence/absence of EWM and VLM in 237 lakes across the Adirondack Park of New York State using freely accessible spatial data. The best EWM model (containing the variables: number of up-stream EWM lakes, UTM X, distance to urban center, UTM Y, and watershed State and Federal road densities) utilized MLR predicting presence/absence with an accuracy of 86.67% and a sensitivity of 90.14%. The best VLM model (containing the variables: number of up-stream VLM lakes, UTM X, and number of boat launches) utilized a MLR predicting presence/absence with an accuracy of 88.30% with a sensitivity of 84.14%. For both EWM and VLM, the presence/absence of the invasive upstream was the strongest predictor of invasion, giving evidence to the futility of managing downstream waters first. The second strongest predictor of invasion for EWM and VLM was UTM X. For EWM, UTM X positively influences invasion while for VLM, UTM X negatively influences invasion, providing evidence of 2 centrally converging geographic invasion sources and pressures.

Sat-PM1-F-5

The SUNY Virtual Herbarium Network: Increasing Access and Improving Botanical Education

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Abstract - Herbaria, collections of preserved plants, are valuable sources of data essential to studies in the biological sciences. In particular, small local herbaria play a critical role in the study of regional biodiversity. The primary goal of this project is to increase access to herbarium collections at SUNY institutions, as well as to develop and disseminate a new pedagogy for enhancing botanical education using digitized specimens. The Jewell and Arline Moss Settle Herbarium at SUNY Oneonta (SUCO) currently contains over 14,000 specimens including algae, bryophytes, lycophytes, ferns, gymnosperms, angiosperms, and fungi. Since August of 2016, a team of undergraduate Assistant Curators have been databasing and imaging the SUCO collections, and making them accessible via an open-access data portal. These herbaria data are being used to develop 3 web-based learning modules designed to engage students, develop skills in scientific inquiry, and enhance botanically focused courses. Once complete, these modules will be implemented and evaluated in a variety of learning environments from introductory biology courses to upper-level botany classes. In addition, this project relies heavily on student interns in both biology and art in order to promote a unique type of collaborative, interdisciplinary learning.

Sat-PM1-C-5

Ecological Predictors and Consequences of Non-native Earthworms in Kennebec County, ME

Julia A. Rogers (University of Connecticut, Storrs, CT, julia.a.rogers@uconn.edu) and **Cathy D. Collins** (Bard College, Annondale-on-Hudson, NY, ccollins@bard.edu)

Abstract - Non-native earthworms are found throughout much of the United States and Canada in areas that were earthworm-free following the most recent glaciation, a process that has been facilitated by humans. Following invasion, these earthworms altered nutrient cycling, soil structure, and diversity in forests throughout the northern United States. There are no comprehensive studies of earthworm distributions in forested areas of Maine. We surveyed earthworms in forested recreation areas in Kennebec County, ME, and investigated ecological and landscape attributes that may predict their presence, as well as differences between sites with and without earthworms that may be explained by earthworm presence. To examine whether the presence of earthworms modifies forests, we measured environmental variables known from other studies to be affected by worms. We found earthworms at 12 out of 23 sites, which was best predicted by distance to roads, forest size, and forest composition. Sample sites near roads, in small deciduous forests were more likely to have earthworms. We also found that locations with earthworms have less surface litter and more soil phosphorous, suggesting that earthworms modify soils in these forests. Our study is the first to explore the distribution of earthworms in natural forests in Maine, and our findings provide evidence that roads facilitate earthworm invasion, with measurable consequences for soil properties.

Sun-AM1-F-2

Partitioning the Effects of Concurrent Consequences of Floods in Riparian Plant Communities

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Abstract - The diversity of riparian (or riverbank) plant communities is often attributed at least in part to the hydrological characteristics of that habitat, including the influence of flood events. Flood disturbances have several concurrent effects on riparian vegetation. For instance, plants may be submerged under water or buried under sediments deposited by floodwaters, and may benefit from nutrients added to the riparian substrate as those sediments are deposited. As flood events have multiple, simultaneous effects on the riparian zone, it is difficult to understand how each of these effects individually influences riparian vegetation. To examine these effects individually, I conducted a greenhouse experiment to examine the independent effects of submergence under water, burial under sediments, and nutrient addition on the growth and survival of 6 herbaceous plant species. These included 3 riparian species (*Bidens frondosa* [Devil's Beggar-ticks], *Persicaria pennsylvanica* [Pennsylvania Smartweed], and *Prunella vulgaris* [Common Selfheal]) and 3 upland species (*Solidago flexicaulis* [Zig-zag Goldenrod], *Persicaria virginiana* [Jumpseed], and *Marrubium vulgare* [White Horehound]), all commonly observed in previous field studies of riparian and adjacent upland areas in the Upper Hudson Watershed, NY. All but 1 species experienced increased growth under nutrient addition. All riparian species experienced high survivorship under submergence, but showed differing responses to burial. All upland species showed poor survivorship when buried under sediment, suggesting that burial under sediments may play a primary role in excluding the 3 non-riparian species from riparian zones, while the 3 riparian species differ in which consequences of floods facilitate or hinder growth and survivorship. These results begin to provide a better understanding of the specific abiotic conditions that might underlie the composition of riparian plant communities and the role floods play in facilitating the establishment of some species and excluding other species from this habitat.

Sat-PM2-D-3

Avian Spring Migration as a Dispersal Mechanism for an Invasive Insect Pest

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Abstract - Birds have long been hypothesized as dispersal agents for plants, animals, and other organisms, particularly during migration. *Adelges tsugae* (Hemlock Woolly Adelgid) is a largely sessile, invasive insect that has decimated *Tsuga canadensis* (Eastern Hemlock) forests and continues to spread northward. Models of adelgid spread consistently underestimate the insect's arrival in uninfested regions, citing the lack of data documenting long-distance dispersal events. Since dispersing adelgid nymphs ("crawlers") are most abundant from late April to late May in the Northeast US, we investigated the potential for birds to disperse this invasive insect over long distances during spring migration. We experimentally tested 2 modes of adelgid crawler transfer between hemlock branches and mounted passerine specimens, collecting crawlers from the birds' feathers after a period of contact with infested branches. Crawler transfer was greater when birds actively brushed against an infested branch than when they simply perched, and transfer rates peaked in May, coinciding with the phenological peak emergence of adelgid crawlers. Rates of crawler transfer also increased with adelgid infestation density on a hemlock branch. We additionally present results of a preliminary study documenting adelgid crawlers "hitchhiking" on wild birds in Connecticut. Again, we found significantly more crawlers on wild birds during spring migration than during the subsequent breeding season. Our results implicate an influence of avian ecology and life history in the dispersal of this destructive, invasive insect.

Sun-AM2-F-2

Southern Pine Beetle in Connecticut: Discovery, and Distribution

Claire Rutledge (The Connecticut Agricultural Experiment Station, New Haven, CT; Claire.Rutledge@ct.gov) and Adriana Arango (The Connecticut Agricultural Experiment Station, New Haven, CT; Adriana.arango@ct.gov)

Abstract - *Dendroctonus frontalis* (Southern Pine Beetle [SPB]) is a primary pest of *Pinus* (pine) that attacks healthy trees en masse, overwhelming their defenses. The beetles feed on phloem as well as vectoring aggressive phytopathogenic fungi such as the "blue stain" fungi *Ceratocystis minor*. SPB has been moving north from its origins in Central America over the past 400 years. It is a major scourge of the timber industry in the southern US. Its northern range is thought to be limited by minimum winter temperatures; mature larvae are the most cold tolerant life-stage and are killed at -20 °C. SPB was found in the Pine Barrens of NJ in 2008 and in Long Island, NY, in fall of 2014. On 17 March 2015, SPB was found attacking *Pinus resinosa* (Red Pine) in Wallingford, CT. In this talk, I'll discuss where in Connecticut we have found SPB, what hosts SPB are attacking, and the results of the SPB-trapping survey for 2015 and 2016.

Sat-AM1-F-3

Behavioral Response of *Nasonia vitripennis* (Hymenoptera) when Exposed to Different Species of Carrion

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Abstract - *Nasonia vitripennis* is a parasitoid wasp that frequents carrion and lays eggs in the pupae of filth flies (Diptera: Sarcophagidae and Calliphoridae). A previous study suggested that *N. vitripennis* was attracted to pork meat after 4 days of decay and then lost attraction in later decomposition. The same study also used electroantennography (EAG) and olfactometry bioassays to determine there were 3 chemical stimulants (butanoic acid, butan-1-ol, and dimethyldisulfide) originating from the meat that created a response in *N. vitripennis*. However, dimethyldisulfide (DMDS) was the only chemical that elicited an attractive response. DMDS is a common volatile organic compound that can be found in varying concentrations in carrion. The purpose of this study was to observe *N. vitripennis* behavior when introduced to other species of carrion in comparison to swine. Pig, chicken, and cow meat were aged up to 8 days. On days 2, 4, 6, and 8, behavior of *N. vitripennis* was observed using a Y-tube made of silicone tubing and connectors sealed with Parafilm. Individuals were given 10 minutes to choose between the meat and an empty control vial. The study suggests that there are differences in *N. vitripennis* behavior when exposed to decaying meats of different species, as well as differences related to length of decomposition. Interestingly, *Nasonia vitripennis* exhibited attraction to pork on the sixth day of decomposition but not when it had been aged 2, 4, or 8 days.

Sat-AM2-E-1

Annual Variation in Plant and Leaf Characteristics of Three Common Ferns of the Northeastern Forest

Joanne M. Sharpe (Sharplex Services, Edgecomb, Maine; joannesharpe@juno.com)

Abstract - Two long-term demographic studies to assess annual variation in fern growth and spore production of 3 common temperate species of ferns show differences among species as well as year-to-year variation in a variety of plant and leaf characteristics. In both studies, I monitored individual plants annually in the fall of each year and recorded plant leaf count (sterile and fertile) and leaf lengths, as well as any evidence of plant mortality. The focus of the first study on private property in Dresden Maine was on *Dryopteris intermedia* (Evergreen Wood Fern) and *Polystichum acrostichoides* (Christmas Fern) and began in 1994 and ended in 2000. All individuals were reproductively mature and yet both the percentage of plants producing spores and the percentage of fertile leaves produced by an individual varied: from near 40% (*D. intermedia* 1998) to above 90% (*P. acrostichoides* in 1999) with little concordance in the year-to-year patterns of the 2 species. The second study (still ongoing in 2017) began in 2000 at the Holt Research Forest in nearby Arrowsic Maine and focuses on *D. intermedia* and *Dryopteris marginalis* (Marginal Wood Fern). Reproductively mature individuals of *D. intermedia* consistently produced relatively fewer spore-bearing leaves than did *D. marginalis*. While both populations had lost about 10% of the originally marked individuals after 10 years of observation, *D. marginalis* mortality rates were consistent from year to year while *D. intermedia* didn't begin to lose many plants until 2008. These and other examples of annual variation from long-term studies suggest that abundance is only part of the ecosystem dynamic of the understory northeastern forest community.

Sat-AM2-D-2

Forest Caterpillars: How Dietary Specialization Mediates Their Susceptibility to Predators

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Abstract - Forest caterpillars constitute an ecologically important and diverse group of herbivores that damage trees and serve as food for predators. Some caterpillar species have diets restricted to a single plant species, whereas others feed on many plant taxa. The degree of dietary specialization of herbivorous insects can mediate both their damaging effects to plants as well as their susceptibility to predators. According to several past studies, caterpillars with a high degree of dietary specialization are able to use their specific interactions with host plants to gain superior anti-predator defenses relative to dietary generalists. For example, dietary specialists, such as monarch butterfly caterpillars, can co-opt the chemical defenses of their host plants for their own anti-predator defense. Dietary specialization might alternatively enable caterpillars to possess superior camouflage by closely matching the morphology of their specific host plants. We tested in Connecticut forests the hypothesis that dietary specialization entails superior anti-predator defenses of caterpillars. We conducted field trials to compare the abundance of caterpillar species between experimental treatments, where we physically excluded predators from tree branches, and control treatments in which we did not hinder predator access to tree branches. We specifically excluded birds and ants in different experimental treatments, allowing us to test our hypothesis in relation to each predator type. In support of our hypothesis, dietary specialist caterpillars were less susceptible to bird predation than were dietary generalists. The advantages of specialists accrued from superior camouflage and defenses associated with warning signals. Contrary to our hypothesis, dietary specialists were more susceptible to ant predation than were dietary generalists. The advantages of generalists in this case were at least partly related to superior behavioral defenses, such as thrashing, biting, dropping, and rappelling from plants. These results imply that birds and ants play different roles in controlling caterpillar populations in the forest, depending on the species of caterpillar. Because tree species differ in the proportion of dietary specialist and generalist caterpillar species feeding on them, birds and ants are likely to differ in the degree of pest-control service they provide to different tree species.

Sat-AM1-E-1

Light Pollution and Its Ecological Impact

Leo Smith (International Dark-Sky Association, Suffield, CT; leo@smith.net)

Abstract - Outdoor lighting has been around quite a while, but only within the past 100 years or so has outdoor lighting proliferated, first with incandescent, later with high intensity discharge lamps such as high-pressure sodium, and finally with LED technology. Lighting leaves its ecological mark, whether disturbing the nesting of sea turtles, flight patterns of migratory birds that use the stars for navigation, or mating and times for foraging of a range of species. These ecological consequences of light pollution have become increasingly pronounced with the arrival of LED technology. How does LED technology present an ecological problem? What are solutions can be used to mitigate the damage?

Sun-AM1-E-1

An Integrated Investigation of Thrush Stopover Biology on the South Shore of Lake Ontario

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Abstract - Habitats located along the south shore of Lake Ontario are widely used by migrating landbirds during their annual migrations to and from their breeding grounds. In the fall, many songbirds make use of the food resources available in these lakeshore stopover sites before continuing their southward migrations. One such area near Braddock Bay, Lake Ontario, is the site of a migration monitoring station where we studied multiple aspects of stopover biology, including habitat quality and the physiological condition of target species each fall since 2012. In this study, we summarize patterns of nutritional and physiological condition measured via plasma metabolite profiling of 3 species of thrush (*Catharus*) captured at the Braddock Bay Bird Observatory over consecutive fall seasons. Our goal was to examine annual variation in the birds' stopover physiology and investigate possible links to diet quality and availability of fall-ripening fruits. We collected blood samples and morphological measurements from birds captured during the fall migration periods over the study years and analyzed the plasma spectrophotometrically to determine circulating concentrations of triglycerides (an indicator of fat deposition) and other indices of nutrient utilization (uric acid, glucose, free fatty acids), in addition to leucocyte profiles (an indicator of chronic stress) measured in fall 2016. We compared inter- and intra-annual metabolite patterns and data on the empirically measured nutritional composition of common local fruits that are consumed by these birds in the fall. We also report on a preliminary physiological examination of captive thrush fed native and non-native fruits. Results confirmed that certain aspects of thrush physiology may differ annually, possibly in response to temporal variation in the availability of certain fruits and the timing of migration through the area by individual species. Such variation may impact the foraging needs of birds at this site and help to inform habitat management aimed at maintaining specific food resources that are likely to offer a nutritional advantage to refueling birds during migration stopovers.

Sun-AM2-D-3

Breeding Season and Larval Development Variability of Wood Frogs from the White Mountains, NH, and Wachusett Mt., MA

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Abstract - There are 4 ponds in the White Mountains where we have collected relatively comprehensive data on breeding (call intensity and duration), developmental characteristics of tadpoles, and size at metamorphosis of *Lithobates sylvaticus* (Wood Frog). Two of the ponds in the White Mountains are just below treeline at ~1220 m (~4000 ft) in elevation (Eagle and Hermit Lake) and the other 2 are above treeline at ~1525 m (~5000 ft) in elevation (Lakes of the Clouds includes 2 ponds within 61 m [200 ft] of one another). I will explain how the amphibian communities vary from pond to pond, but focus on differences in developmental rates and size at metamorphosis of Wood Frogs from each pond, including multiple years from some ponds. We have also compared these results to 2 ponds from Wachusett Mountain in Worcester County, MA. At the alpine ponds in the White Mountains, we have documented metamorphosis of several species of frogs between the end of July (2012), end of August (2013–2014), and mid-September (2015–2016). At Wachusett Mountain, Wood Frogs undergo metamorphosis between July and August (2013). The overall greater size of the Wood Frog tadpoles and metamorphs in the White Mountains is likely due to a variety of factors (temperature, nutrition, predators, shade) and how they influence their biology during the larval developmental period. Elevation is not the most important driver of size at metamorphosis as demonstrated at Lakes of the Clouds where the 2 ponds are at essentially the same elevation, but the development rate of tadpoles from one pond (Lower Lake) consistently lag behind those from the other (Upper Lake). At Wachusett Mountain, both the study ponds dry up most years, and Wood Frogs from the open-canopy pond grew slightly larger, more rapidly, and metamorphosed sooner compared to tadpoles from the closed-canopy pond. All our study ponds in the White Mountains are permanent and do not contain fish. Therefore, Wood Frogs in those ponds are relieved from the 2 most common threats, desiccation and fish predators. In the White Mountains, selection has promoted certain growth and development characteristics that are not normally allowed to be expressed in more-common ecological settings.

Sun-PM2-E-2

An Analysis of the Role that Mt. Prospect Plays in the Pemigewasset Watershed, NH

Larry T. Spencer (Biological Sciences Department, Plymouth State University, Plymouth, NH: lts@plymouth.edu)

Abstract - Mt. Prospect looms on the horizon when looking northeastward from the Plymouth State University campus in Plymouth, NH. The Holderness Conservation Commission has as one of its goals the protection of the uplands within the town, and Mt. Prospect is one of those uplands. As chair of that Commission, I undertook a GIS/remote sensing analysis of the mountain. This presentation will discuss the outcomes of that analysis. In the analysis, I examined parcel size, slope aspect and slope change, land use and land change, and precipitation intercepted by the mountain. I then will relate those aspects to the natural history of the Mt. Prospect region.

Sun-AM1-F-1

Fighting the Bite: Tick-Associated Diseases and Integrated Tick Management

Kirby C. Stafford III (The Connecticut Experiment Station, New Haven, CT; Kirby.Stafford@ct.gov)

Abstract - Increasing prevalence of Lyme disease and the emergence of other tick-associated human diseases in the United States have become a major public health concern. A wide variety of prevention and control strategies have been adapted or investigated to reduce human risk of disease, but field studies incorporating integrated pest management, ecological, and human behavior concepts are limited. This talk will highlight the prevalence of tick-borne pathogens, the human risk of tick-borne disease, and the current status of tick management research, as well as present some of the work being conducted at the Experiment Station.

Sun-PM2-J-3

Conservation of the Timber Rattlesnake in Massachusetts

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Abstract - *Crotalus horridus* (Timber Rattlesnake) populations have become increasingly fragmented and isolated during the past 300 years, and this trend is probably most pronounced near the northeastern edge of their distribution in Massachusetts. Currently, populations exist at 5 sites in the state, with only 1 site large enough to be considered a metapopulation. We evaluated connectivity between Massachusetts den sites of Timber Rattlesnakes through a combination of genetic analyses and radio telemetry. Genetic structure was assessed using 15 microsatellite loci, and analyzed with 300 samples taken from all New England populations. Individual movements of snakes were measured in the metapopulation over the course of 5 years. Preliminary results indicate that geographic distance is a poor predictor of genetic distance between dens, both between and within sites. Telemetry results have provided an initial mechanistic explanation for genetic structure at 1 site, but our understanding of between site variations in structure is hampered by poor knowledge of historical events leading to population isolation. Observations of facial lesions have also been noticed in these populations, and studied further with a USFW grant. Some of these individuals have been tracked over multiple years, with some individuals appearing to be unaffected by the disease, but more drastic conditions reported in other Massachusetts populations. These findings should be useful to natural resource managers interested in maintaining genetically diverse and viable populations of Timber Rattlesnakes in an increasingly fragmented landscape. Currently Massachusetts is proposing customized conservation action items for each site, in addition to the possibility of introducing the species to a new site.

Sat-PM1-D-1

Excess Evening Light: Delay in Transition to Nighttime Physiology

Richard Stevens (University of Connecticut Health Center, Farmington, CT; bugs@uchc.edu).

Abstract - Before electricity, the normal transition to nighttime physiology began at dusk. These circadian changes are pervasive and include lowering of body temperature, slowing of metabolism, abatement of hunger, changes in hormone levels, and increased propensity for sleep. In other words, the body calms down. Dark is required for nighttime physiology, but sleep is not; normal sleep duration prior to electricity was probably only about 6 to 7 hours, and came in two or more bouts, all within a period of 11 hours of "circadian dark". Wood fire and candles do not interrupt nighttime physiology, but electric light certainly can, depending on its intensity and blue content. This circadian biology has important implications for both our short-term well-being and long-term health. Which means that how we light our evening and nights matters. In the modern world, many if not most people have "circadian dark" for only the 7 hours they are in bed. A current hot topic in this arena is the new "white" LED street lighting that is sweeping the country, and how it may contribute to circadian disruption.

Sun-AM1-E-2

Species Distribution Modeling of the Threatened Blanding's Turtle (*Emydoidea blandingii*) in New York

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Abstract - The delineation of a species range is challenging because of the number of interacting factors at multiple spatial scales affecting a species' distribution. Species distribution models (SDM) can be used to identify factors that can potentially define a range edge. We evaluated the predictive success of two SDM approaches, maximum entropy models (Maxent) and generalized linear models (GLM), at determining the range edge for the threatened, *Emydoidea blandingii* (Blanding's Turtle) in northeastern New York. This is the first study comparing performance of two SDM approaches using a large sample size of occurrence records in a small geographic area (585,000 ha) at the range edge of a rare species. Using the software ArcGIS, we constructed and validated SDMs using presence/absence records (GLM) and presence/background records (Maxent) with 11 environmental predictor variables. We found that Maxent was more successful at predicting habitat suitability than GLM. Our results also indicated that a distinct environmental range edge is associated with an elevation gradient. Both GLM and Maxent models also projected the presence of suitable habitat outside of the current range, including locations with known disjunct populations. We conclude that a presence/background SDM approach like Maxent is valid when accurate data on locational absences are lacking. SDM used to understand the factors shaping the range edge can aid with planning habitat conservation and management of threatened species.

Sat-PM1-D-4

Conservation of Sri Lankan Turtles: Population Status Outside the Protected Area Network

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Abstract - Turtles are integral to freshwater and wetland ecosystem functions as herbivores, carnivores, and scavengers in food webs. Turtles have extensive home ranges and utilize numerous aquatic and woodland habitats to satisfy different life-history requirements; therefore, “fortress conservation” is inadequate in turtle conservation. We investigated population densities of two “widely-distributed” species—*Melanochelys trijuga* (Common Black Turtle) and *Lissemys ceylonensis* (Sri Lanka Flap-shelled Turtle)—in Sri Lanka at 79 riverine habitats across urban–rural gradients. The population densities of each focal species were <2 individuals ha⁻¹. Habitats intercepting greatest extents of urbanization had the lowest densities of both species. Extent of marshlands and availability of large woody debris positively correlated with turtle densities. An interview survey we conducted revealed that ½ of local inhabitants have slaughtered turtles, while nearly ¾ of locals consumed turtles regularly. Only 1/5 of the interviewees were aware of environmental benefits of turtles. Turtles rank high on the list of most-imperiled vertebrates of the northeastern US (NE-US), and our study can provide insights for regional turtle conservation in this part of the world as well. Life-history, natural history, and conservation status of turtles are comparable in Sri Lanka and NE-US. The causes of imperilment in both regions include wetland loss and fragmentation, river impoundment, hydrologic modifications, altered riparian zone, water pollution, loss of structural diversity in riverscapes, and overharvesting. In NE-US, turtle populations are not limited to protected areas; many species nest in homesteads, hibernate in unprotected wetlands, and disperse through the urban matrix. We recommend that least-altered and rural riverscapes be used as dispersal corridors to maintain turtle metapopulation dynamics. Over 50% of the undeveloped woodlands and rural wilderness, where conservation opportunities exist in NE-US, are managed by numerous stewards for different purposes. Therefore, delineation of multiuse conservation networks at ecoregion-scale (the Acadian/Appalachian highlands, northern Coastal Plains), including management of critical core habitats and buffer zones are imperative. Turtle habitats confer many ecosystem services: flood mitigation, water purification, groundwater recharge, and freshwater fish conservation. Therefore, turtles are umbrella species whose protection ensures conservation of imperiled freshwater biodiversity. Furthermore, turtles are charismatic, and thus can serve as effective focal species for awareness programs, conservation education, and generating conservation dollars in both Sri Lanka and NE-US.

Sat-PM1-E-5

The Consortium of Northeastern Herbaria: Facilitating Research and Conservation

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Abstract - The Consortium of Northeastern Herbaria (CNH; neherbaria.org) is a group of 67 herbaria in Northeastern North America whose main goal is to provide online access to specimen data housed in member institutions, especially from regional collections. Subsidiary goals of the Consortium include facilitating herbarium-based biodiversity research and conservation; sharing of knowledge on digitization and other museum informatics technologies; coordinating with other regional, national, and international networks and organizations; and obtaining funding to support the Consortium’s goals. Since CNH was officially formed in 2008, the group has focused on a variety of organizational, community development, training and education, fundraising, and digitization activities. These activities have allowed the Consortium make considerable progress towards its goals. One major accomplishment was the establishment of a data-sharing portal, utilizing Symbiota software, where almost 1.2 million specimen-occurrence records are being shared (portal.neherbaria.org). This portal provides text- and map-based searching, editing, and download functionalities, among other things. Another important development was the award to a group of CNH member institutions of a National Science Foundation Advancing Digitization of Biological Collections Program grant to create a Thematic Collections Network whose aim was to database and image New England specimens. This collaborative grant has enabled the digital capture of specimen data and images from vascular plant specimens located at 17 large to small herbaria across New England. This presentation will provide an overview of the Consortium’s activities, a tour of our data-sharing portal, a summary of digitization activities, and a brief synopsis of the portal dataset.

Sat-PM1-C-1

Fronds of *Dryopteris intermedia* Need to be Prostrate to Reduce Winter Damage

Jack T. Tessier (SUNY Delhi, Delhi, NY; tessiejt@delhi.edu)

Abstract - *Dryopteris intermedia* (Common Wood Fern) is the most common fern in the northeast United States. Its wintergreen fronds soften the base of their stipe in fall and survive the winter under snow, allowing them to photosynthesize in the spring and provide an energetic benefit to the plant. This study addressed whether or not the softening of the stipe is critical to the condition of the frond in spring. I kept the fronds of 12 *D. intermedia* plants upright in garden cages through the winter of 2015–2016 and left those of 12 other plants prostrate as controls. In the spring of 2016, a greater portion of the frond surface area had frost damage on the upright fronds than those of the control plants (0.62 vs. 0.22, $P < 0.0001$), and a greater portion of the fronds were broken in the upright plants than in the control plants (0.63 vs. 0.04, $P < 0.0001$). These results suggest that the softening of the stipe was a critical evolutionary step in the development of the wintergreen habit in *D. intermedia* and, presumably, other large ferns.

Sat-AM2-D-1

Feeding by *Priapulius caudatus* (Cephalorhycha: Priapulidae): Effects of Seasonal Temperature Change and Molting

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Abstract - The ecdysozoan *Priapulius caudatus* belongs to an ancient group of exclusively marine worms that reigned as among the most-abundant benthic metazoans during the Cambrian. Usually found at great depths, this species can occasionally be found among intertidal habitats fed by exceptionally cold sea water and predominated by soft mud, as in the Lower Bay of Fundy. Live priapulids were collected there and the effects of molting and seasonally changing ambient sea water temperature on feeding were observed in the laboratory beginning in February. Feeding increased as ambient sea water temperatures increased from March through April, a relationship significantly correlated ($P < 0.001$). This association rapidly deteriorated once 11 °C was reached in May with no animals feeding above 13 °C. Priapulids fed until the first molt day when feeding significantly decreased ($P = 0.016$). This response was short-lived, and feeding slowly resumed among animals within a week post-molt. Exuvia were not consumed. The onset of molting followed color changes in cuticle appearance and was significantly correlated with increasing temperature ($P < 0.001$). Molting was rapid, with the exuviae clearly separated from the new cuticle within 24 h at places where the process began. Without substrate to burrow into, animals emerged from shed exuviae between 3 to 29 days, with larger animals taking longer. While the cold deep-sea is the primary habitat of *P. caudatus*, this species shares some of the effects of temperature and molting on feeding shown by other ecdysozoans. The observations made during this study place a limit on where *P. caudatus* might be found intertidally.

Sat-PM1-J-3

Effects of Habitat Fragmentation on the Population Genetics of *Plethodon cinereus*

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Abstract - Genetic diversity is important to the long-term survival of a species. Populations with low genetic diversity are more likely to go extinct due to an inability to adapt to environmental changes or from accumulation of deleterious alleles. Habitat fragmentation may result in lower genetic diversity by disrupting gene flow between subpopulations created by urbanization, such as roads, buildings, and agricultural fields. Our study explores the effects of habitat fragmentation on the genetic diversity of *Plethodon cinereus* (Eastern Red-backed Salamander). Tissue samples were collected from 20–30 individuals from each of 1–3 different subpopulations within 4 larger forest sites that differed in their total area (e.g., small fragments of 3–60 ha or large fragments of >1000 ha). Two sites were small fragments that are completely surrounded by suburban or agricultural areas in eastern Massachusetts (“fragmented” forest; 3 subpopulations). The other 2 sites were large, continuous forests located in western Massachusetts (“continuous” forest; 4 subpopulations). We extracted DNA and amplified 7 microsatellite loci. We then measured heterozygosity, total number of alleles, and population differentiation. Heterozygosity and total number of alleles were not significantly different between fragmented and continuous subpopulations across all 7 loci. We found stronger differentiation than expected (higher F_{ST}) between the 2 fragmented subpopulations. This suggests that while overall levels of genetic diversity may not be directly affected by habitat fragmentation, dispersal is limited between fragmented subpopulations (reflected in their higher F_{ST} compared to continuous subpopulations).

Sun-PM2-E-1

Wood Turtle Movements in a Small Berkshire Stream

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Abstract - A small population of *Glyptemys insculpta* (Wood Turtle) has been casually observed for 20 years, with some of those years including more-intensive tracking using radio-telemetry. All recorded locations of wood turtles were associated with terrestrial foraging, streambank basking, open-land nesting, in-stream travels, or underwater wintering. Up to 35 individual turtles were observed and identified either by plastral pattern, notching, transmitter, or a combination of all 3 methods. The 8.5-mile stream flows through fairly unspoiled landscapes to its junction with the Housatonic, a river that has high concentrations of PCBs and other pollutants. Much of the turtles' stream is relatively protected (State Park, MAS sanctuary, or posted land), though road construction debris, egg depredation, and dams present some threats to the turtles and their habitat. Small dams, constructed in the 1930s have been considered at least partial barriers to Wood Turtles and other aquatic organisms. One dam on MAS property was removed in 2014 when turtles with radios were being monitored. Use of the upstream reach was almost immediately apparent.

Sat-PM1-D-5

Using Remotely Sensed Data to Delineate Phragmites in the Hudson River

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Abstract - *Phragmites australis* (Common Reed) is an invasive species that has aggressively colonized marshes and areas along the shoreline of the Hudson River estuary, altering the biological communities and structural characteristics of these habitats. This paper describes a method to identify and delineate the extent of *Phragmites* invasions in the study area of the tidal Hudson River Estuary using object-based image analysis (OBIA) techniques. Delineation of *Phragmites* is accomplished using high-resolution aerial imagery from the National Agricultural Imagery Program (NAIP) and elevation and surface models derived from coastal light detection and ranging (LiDAR) data. OBIA offers advantages over pixel-based approaches to land-cover classification that only utilize spectral analysis, by segmenting an image into spectrally homogenous objects and then incorporating contextual information, such as surface height or object shape, to improve classification accuracy.

Sat-PM2-D-2

Can C-values Provide Appropriate Estimates of Disturbance Thresholds for Rare Plant Species? Evidence from American Bittersweet (*Celastrus scandens*) Populations in Western New York

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Abstract - Coefficients of Conservatism (CoC), also called C-values, provide estimates of the disturbance thresholds that native plant species can withstand in their given habitats. These values provide implications for conservation and management, and also provide an analysis of habitat integrity. While these values are often assigned by each region's most experienced botanists, they can also come with an inherent sense of bias due to differing opinions on individual species and their range limits. In the summer of 2016, we sought to determine the efficacy of using C values to assess species' disturbance thresholds by monitoring populations of the state-listed rare vine *Celastrus scandens* (American Bittersweet) within Western New York. Study plots ranging in size from 100 m² to 150 m² were sampled using a combination of methods from both the Forest Inventory Analysis (FIA) and Plant Ecology Laboratory (PEL). Average C-scores were then calculated for each site using the CoC values assigned for each plant species through New York State's list of C-values. Preliminary results indicate that while *Celastrus scandens* has a C-value of 6 (out of 10) within New York, this value may actually underestimate the vine's disturbance threshold, given that one site had a mean C-value below 2. These results suggest that anthropogenic disturbance may not be the only factor contributing to the increasing rarity of American Bittersweet within New York State, and that other environmental or biological factors may need to be considered.

Sun-AM1-D-2

Monitoring and Managing Ash (MaMA): Working Together to address the Threat from EAB

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Abstract - *Agrilus planipennis* (Emerald Ash Borer [EAB]) has been found in every Northeast state except Maine and Vermont, with large areas of some states already heavily infested. The 3 species of ash trees that occur commonly in this region—*Fraxinus americana* (White Ash), *F. pennsylvanica* (Green Ash), and *F. nigra* (Black Ash)—are highly susceptible to EAB, suffering nearly 100% mortality in areas in the Midwest in which EAB has been longer established. Therefore, EAB invasion will likely cause widespread functional extirpation of ash across the region. Consequences of ash loss go beyond the loss of the trees themselves, and can include—among other things—plant invasion facilitation, hydrological changes, decreased property values, threats to human safety and infrastructure from falling trees, and significant costs to municipalities and property owners. Although it is tempting to just despair and “kiss our ash goodbye”, steps can be taken both to mitigate impacts locally and help find long-term solutions to EAB’s challenges. The Monitoring and Managing Ash (MaMA) program, undertaken by the Ecological Research Institute (ERI) as a component of the Strategy for Conserving Ash Trees in the Northeast project led by the New York Botanical Garden, aims to involve citizen scientists and land managers in activities that can advance both these goals—local impact mitigation and the search for broader long-term solutions. In this program, participants will choose a site and then be provided guidance necessary to survey its ash trees, assess their EAB damage, identify priority trees for conservation (based on various criteria, e.g., whether the tree is a hazard, whether its demise will create an invasive plant hotspot), and consider mitigation approaches (e.g., trunk injection to prolong tree life or underplanting to deter invasive plants). Participants will also collect data aimed at developing long-term solutions, especially by locating lingering ash which might hold the genes for EAB resistance. Materials, including seeds as well as samples for molecular and morphological analyses, can also be collected to document and preserve ash diversity. This presentation consists of an overview of this new program and an invitation for potential partner institutions and volunteers to get involved.

Sat-PM2-C-4

Diversity and Dilution: Impacts of Medium-Sized Mammal Diversity on *Borrelia burgdorferi* Prevalence in Fragmented and Unfragmented Habitats in Connecticut

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Abstract - Medium-sized mammals can serve as reservoir hosts for *Borrelia burgdorferi*, the causal agent of Lyme disease, but also create a dilution effect that can reduce local vector *Ixodes scapularis* (Blacklegged Tick) infection prevalence. In 2015 and 2016, camera traps were deployed on residential properties and relatively large, unfragmented parcels of open space throughout Connecticut. Past modeling research has suggested that large, contiguous forest blocks would provide a more intact ecosystem resulting in increased diversity of wildlife, thus diluting *Borrelia burgdorferi* presence. But in forested, urbanized states like Connecticut, preliminary data analyses suggest otherwise. This presentation will focus on changing human–wildlife interactions and habitat diversity in forested residential areas and their potential impacts on human health.

Sun-PM2-J-5

Factors Affecting Growth Rates of Blanding's Turtles in Captivity and Survival Rates Post-Release

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Abstract - In recent years, many turtle conservationists have initiated headstarting programs to improve the survival probabilities of young individuals of chelonian species of conservation concern. The principle underlying this conservation intervention is that, presumably, by raising hatchling turtles in captivity to a considerably larger size than at hatching, managers can reduce the mortality rates typical of very small turtles. It also presumes that mortality rates, up to a point, are inversely related to the body weight and length of hatchlings at release. Since 2007, we have raised cohorts of 10 to 90 hatchling *Emydoidea blandingii* (Blanding's Turtle) in captivity prior to their release at sites in eastern Massachusetts. Through radiotelemetry of 89 headstarted individuals released at Great Meadows NWR, we have documented survival rates over the first few years post-release that are likely at least 10-fold greater than those experienced by unmanipulated young Blanding's turtles. Since the advantages accrued in survivorship likely derive primarily from the growth that the turtles experience in captivity prior to release into their natal habitats, we have also examined factors influencing the size at release and rates of growth experienced by the hatchlings that we have headstarted in more than 20 schools and institutions. Our analyses document that hatching year, hatching gender, size at hatching, maternal identity, and headstarting institution all affect at least some measures of hatchling growth. One salient finding, however, is that growth rates have generally declined over time among turtles raised within the same schools (overall the mean weight of headstarted Blanding's Turtles upon release for the 2014 and 2015 was 46.1% less than the mean weight of the 2009 and 2010 cohorts at release). We will discuss our ideas about the causes of this decline in husbandry effectiveness and techniques that we propose to reverse this trend.

Sun-PM2-E-4

What's Really on the Menu? An Evaluation of Host-Plant Literature and Diet Breadth of Caterpillars

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Abstract - Diet breadth of herbivorous insects is of importance to multiple fields of research, including ecology, evolution, biological control, and invasive species management. However the gathering of accurate host-plant data and measurement of diet breadth is a fraught task. The available literature for caterpillars (Lepidoptera) is extensive, but minimally curated. Most secondary sources do not cite their data references, and even primary collecting and rearing records contain errors. We propose that expert curation is required for any study of host-plant datasets where accuracy is essential. The subsequent measurement of diet breadth is also contentious; the definitions of "specialist" and "generalist" are not fixed, and differ between studies. Using a dataset for *Acrionicta* (dagger moths), we evaluate multiple measures of diet breadth: categorical, genus richness, family richness, phylogenetic diversity, and diet-breadth ordination. We have mapped these results onto the most recent molecular phylogeny of *Acrionicta* to compare their utility in defining diet breadth for different clades.

Sat-AM1-E-2