

Linking Above- and Belowground Phenology at Harvard Forest and Beyond

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Abstract - Researchers have long assumed that above- and belowground phenology is synchronous; for example, most parameterizations of belowground carbon allocation in terrestrial biosphere models are based on allometry and represent a fixed fraction of net C uptake. However, using results from meta-analysis as well as empirical data from the Harvard Forest, we show that synchronous root and shoot growth is the exception rather than the rule. We collected root- and shoot-phenology measurements from studies across four biomes (boreal, temperate, Mediterranean, and subtropical). General patterns of root phenology varied widely with up to six growth peaks in one growing season. In the majority of cases, maximum shoot production occurred before root production. A notable exception is the subtropical biome, where root growth consistently peaked before shoot growth. Root growth peaked earlier in study locations with higher median annual temperature and mean annual precipitation ($F_{1,85} = 10.64, P = 0.0016$). Dominant growth form also influenced offset; conifer root growth peaked on average 44.3 ± 11.8 days later than deciduous tree species ($F_{1,32} = 7.52, P = 0.009$). To explore the range of phenological relationships within woody plants in the temperate biome, we compared above- and belowground phenology in three common northeastern tree species: *Quercus rubra* (Northern Red Oak), *Tsuga canadensis* (Eastern Hemlock), and *Fraxinus americana* (White Ash). Greenness index and fine root production were measured beginning in April 2012 through October 2013 at the Harvard Forest in Petersham, MA. Greenness index peaked in late May and early June with one clear maximum growth period. In contrast, root growth was characterized by multiple production peaks. *Q. rubra* and *F. americana* root growth peaked in early and mid-summer, while *T. canadensis* root growth peaked later in the growing season, resulting in greater asynchrony in the phenology of coniferous *T. canadensis*. Timing of C allocation to fine roots may be regulated by climate as well as endogenous factors such as growth form and tradeoffs in C allocated between plant organs. Because plant roots influence soil decomposition by supplying substrate to microbial communities, the phenology of root growth can feed back to affect ecosystem C cycling.

Tue-AM1-C-5

Role of Floral Traits Mediating Pathogen Transmission and Establishment in Pollinators

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Abstract - Several floral microbes are known to be pathogenic to plants or floral visitors such as pollinators. Despite the ecological and economic importance of pathogens deposited in flowers, we often lack a basic understanding of how floral traits influence disease transmission. In particular, nectar and pollen are the primary food items of the majority of bees and frequently contain plant secondary compounds as well as sugars and amino acids. Secondary compounds in leaves can directly reduce herbivore performance but can also provide indirect benefits by reducing predation or parasitism; however, the impacts of secondary compounds on bee pollinators and their pathogens are almost entirely unknown. We infected *Bombus impatiens* (Common Eastern Bumble Bee) with the trypanosome pathogen *Crithidia bombi* and then assigned bees to treatments consuming one of eight secondary compounds at naturally occurring nectar concentrations, compared to a sucrose control solution without secondary compounds. We also examined the effect of exposing *Crithidia* to four different secondary compounds pre-infection, which occurs when *Crithidia* are deposited in flowers and then consumed by uninfected bees. Consumption of four of the eight secondary compounds post-infection, including alkaloids, terpenoids, and iridoid glycosides, significantly reduced *Crithidia* loads, with a reduction of up to 81% compared to the control treatment. By comparison, exposing *Crithidia* to secondary compounds prior to infection had relatively little effect on subsequent pathogen loads. This result suggests that the mechanism by which secondary compounds reduce pathogen load is not through direct toxicity to the pathogen. Our current and future work focus on examining other mechanisms underlying this result, and addressing how floral traits mediate transmission dynamics in the field. Including consideration of plants as key players mediating bee-pathogen interactions may shed important light on traits that can be manipulated to manage disease dynamics in agricultural and natural settings.

Wed-AM1-B-1

Detritivore Response to Garlic Mustard invasion is Morphospecies-Specific

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Abstract - Invasive plants modify the physical structure of forests by displacing native plants, and they change the quantity and quality of litter inputs to the soil. While it has been shown that aboveground animal communities change following plant invasion, it is unclear whether soil inhabitants respond to altered litter inputs. Detritivore abundance was quantified in a forest in Virginia dominated by *Pinus strobus* (White Pine) in the early stages of invasion by the herbaceous biennial, *Alliaria petiolata* (Garlic Mustard). Collembolans (springtails), the dominant detritivores in the epigeal layer (litter, humus, upper soil), were sampled from invaded and uninvaded sites of the forest using high-gradient dynamic extraction over a three-week period in summer 2010 and identified to family. Springtail abundance was nearly three times higher in sites invaded by Garlic Mustard, but responses to invasion were significantly different among morphospecies. Two morphospecies (T1, family Tomoceridae, and E2, Entomobryidae) were more abundant in the invaded sites, two morphospecies (T2 and E1) did not vary in abundance between invaded and uninvaded sites, and one morphospecies (E3) was present only in the invaded sites. These results demonstrate the importance of investigating responses of lower taxonomic levels of detritivores to plant invasions. Exploratory analyses of abiotic characteristics of the epigeal environment revealed a positive relationship between epigeal alkalization and abundance of springtails, consistent with the higher pH measured in the invaded sites (pH 5.5) compared to uninvaded (pH 4.2). Plant-mediated changes in pH may be a mechanism by which invasive plants engineer their physical environment, likely influencing responses of higher trophic levels.

Wed-PM1-C-3

Emerging Dragonfly Distributions at Lentic Wetlands Along Environmental Gradients in Rhode Island

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Abstract - Behavior and ecology of lentic dragonflies (Odonata: Anisoptera) have been widely studied, but distributional landscape patterns of their use of natal habitats have received little attention. With a growing interest in the roles that small wetlands play in developed landscapes for species that require this habitat type at some point in their life cycle, we conducted a cross-seasonal survey of emerging dragonfly populations over three years in Rhode Island. We assessed species richness of dragonfly populations by sampling exuviae, and examined relationships to four environmental variables at the ponds: chloride concentration (a measure of urbanization), surrounding forest cover, wetland size, and wetland distance from the maritime coast. Distributional patterns based on data collected in 2004 and 2005 were compared with patterns from newly selected sites in 2006. Species richness increased with wetland area, but no strong patterns emerged along the other gradients. In contrast to the lack of distributional trends in species richness, some individual species showed significant trends along each variable. As a group, rarely collected species tended to be more common at rural sites, but individual rarely collected species were found at diverse points along each of the habitat gradients analyzed. Because individual lentic dragonfly species vary in their use of reproductive sites along these gradients, diverse wetlands, including both urban and natural sites, have conservation value for the dragonfly fauna of the region.

Wed-PM1-A-3

Phenology Across Life Stages in Understory Native and Invasive Plants in New England

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Abstract - The annual timing of leafing, flowering, and fruiting of invasive plants relative to natives may explain some of their success. Species-level differences may also help predict responses to climate change. Earlier springtime leafing of invasives may lead to an increase in resource acquisition, and by extension may bolster population growth. Later leaf coloration and drop effectively extends the growing season. If phenological separation of species is sensitive to ontogeny, the benefit of a longer growing season may depend on the stage of invasion, such that phenological novelty of seedlings aids establishing populations and mature plant phenological separation better facilitates spread. We used a combination of experimental plantings and wild populations over two years to estimate the phenological separation in leafing events in two pairs of native and invasive ecologically analogous species in southern New England. We compared *Berberis thunbergii* (Japanese Barberry; invasive shrub) to *Lindera benzoin* (Spicebush; native shrub) and *Celastrus orbiculatus* (Oriental Bittersweet; invasive vine) to *Vitis labrusca* (Fox Grape; native vine). Our results show that invasive species display a significantly longer growing season than their native analogs as both seedlings and mature plants. The shrubs had an average difference of 28 days in their growing-season length, and the vines differed by about 13 days. Earlier springtime leafing of invasives drove the pattern in growing-season length; autumn leaf coloration and drop was highly variable within and across species. Across all species in the study, mature plants generally had greater species-level phenological separation than seedlings. However, the differences in leafing phenology within native and invasive species pairs specifically (i.e., *B. thunbergii* vs. *L. benzoin* and *C. orbiculatus* vs. *V. labrusca*) were not significantly different across life stages. We did not find a significant effect of growing-season length on seedling growth, which suggests that phenological differences at the seedling stage are likely poor predictors of invasion success. Linking phenology to demography in mature plants may provide additional insight into current and future distributions.

Tue-AM1-C-3

How Beavers Influence Habitat and Species Diversity of Breeding Birds in the Central Adirondacks

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Abstract - In the terrestrial ecosystems of North America, *Castor canadensis* (American Beaver) play an important role in increasing habitat heterogeneity by creating impounded wetlands in riparian zones and enhance biodiversity at the landscape scale for other taxa including avian communities. To quantify avian species richness and document differences in community composition between Beaver-influenced and uninfluenced areas in the central Adirondack Mountains, we conducted repeat bird counts and vegetation surveys during the breeding season of 2013 within four types of habitat: active Beaver areas, inactive Beaver areas, riparian areas with no known history of Beaver colonization, and intact forested areas. Forest and riparian sites had similar levels of species richness, while both active and inactive Beaver areas had significantly higher levels of species richness, with active Beaver wetlands harboring more species than inactive wetlands. Forest and riparian sites also had high levels of avian community similarity, while forest and Beaver communities were the least similar. We determined that the main drivers influencing species richness included understory complexity, number of tree species, tree density, and basal area of snags. Within Beaver wetlands, species richness was best explained by wetland size and the percentage of herbaceous cover within the wetland. These results indicate that Beavers increase species richness at the landscape scale and, by altering the vegetative structure and composition, provide habitat for species that otherwise do not occur in the forest matrix. This study provides strong rationale for considering other taxa when deciding how to best manage Beaver populations.

Wed-AM1-D-2

Factors Controlling Microbial Responses to *Alliaria petiolata* (Garlic Mustard) Invasion in Northeastern Mixed Forests

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Abstract - The non-native invasive plant *Alliaria petiolata* (Garlic Mustard) produces allelochemicals, including a suite of glucosinolates, which have been observed to inhibit growth and root colonization of mycorrhizal fungi. These fungi provide host plants with essential nutrients and therefore have complex relationships with saprophytic microorganisms. From a microbial community perspective, it is less clear if Garlic Mustard allelopathy suppresses microorganisms that decompose soil organic matter. Microbial responses to Garlic Mustard invasion at a particular sites may therefore covary with the availability of nutrients and soil edaphic properties. Climatic factors contributing to a successful invasion may also be important, but little is known about what environmental factors influence Garlic Mustard invasion. In this study, we analyzed microbial biomass and community composition from eight Garlic Mustard-invaded northeastern forests, representing a geographic nitrogen deposition, annual temperature, and precipitation gradient. On average, microbial biomass was marginally higher in invaded areas than nearby uninvaded plots, but these responses varied significantly by site. Interestingly, only two sites had significantly less fungal and bacterial biomass, and these sites received intermediate precipitation and had the lowest invaded soil nitrate concentrations. Sites with greater microbial biomass received the highest amount of precipitation. There were no clear relationships between the other environmental gradients and microbial biomass. We observed significant differences in microbial community composition between invaded and uninvaded plots. A significant correlation was found between microbial community composition, soil pH, and the amount of clay measured in soils from invaded but not uninvaded plots. In addition, concentrations of nitrate were significantly higher in invaded treatments, along with soil pH. Microbial communities respond to Garlic Mustard invasion on a forest-to-forest level. Forests with intermediate precipitation and low soil nitrate concentrations exhibited microbial suppression associated with invasion. Microorganisms may respond differently to invasion depending on soil mineralogy and chemistry, as indicated by the correlations between certain microbial groups to soil clay content and pH. Management strategies for the eradication of Garlic Mustard may need to be designed specifically for individual forests.

Wed-PM1-B-2

Colony Relocation and Intraspecific Raids by Slavemaking Ants: Meeting Demand for Captive Labor?

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Abstract - Slavemaking ants raid colonies of other ant species to obtain larvae and pupae, which will become the labor force in the slavemaker nests. The enslaved host workers help care for the slavemaker brood, maintain the nests, and forage for food. The Roemer Arboretum at SUNY Geneseo, an 8-hectare patch of secondary successional forest, hosts two species of slavemaking ants, *Formica subintegra* and *F. pergandei*, which both parasitize the locally abundant mound-nesting ant species, *F. glacialis*. Five summers of monitoring the raiding behavior of 11–14 colonies of the slavemakers *F. subintegra* and *F. pergandei* suggest constraints on meeting their demand for host-ant brood, despite the relatively high density of *F. glacialis* nests. Evidence of the limits to availability of hosts to exploit includes frequent relocation of slavemaking ant colonies. Of 14 colonies that have been tracked for at least three of five years, all but one moved at least once by invading existing host nests. Spatial patterns of movements suggest that their purpose is to gain access to more host colonies to raid: the distance moved is typically farther than the mean raiding distance before the move, suggesting an effort to escape their local neighborhood, and the mean distance of raids after relocation is shorter than the distance before relocation. In addition, movements tended to be toward areas of higher local-host density. Another indication of the limits to obtaining host brood to meet colony demand is the phenomenon of slavemaking colonies launching raids on neighboring slavemaker nests. Over the past five summers, four such events have resulted in the apparent elimination of the raided colony. Colony relocation and antagonism between slavemaking ant colonies are best explained by efforts to improve raiding success by seeking areas of higher host availability and monopolizing access to these host nests. Such strategies are likely an important component of the ecology of slavemaking ants that contributes to the dynamic nature of their interaction with the host-ant population.

Wed-PM1-A-1

Constructing Vernal Pools for Amphibians: Translating Natural History into Successful Restoration

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Abstract - Vernal pool construction has been proposed to mitigate for historic and ongoing wetland losses and to promote conservation of pool-breeding amphibians. However, the practice is controversial because outcomes are unpredictable and few guidelines exist for improving the probability of successful outcomes under varying circumstances. *Lithobates sylvaticus* (Wood Frog) and *Ambystoma maculatum* (Spotted Salamander) are common amphibian species that use vernal pools in their embryo and larval stages, but spend the majority of their lives after metamorphosis in terrestrial uplands surrounding their natal or breeding sites. Despite their tendency to co-occur and their generally similar life histories, these species have very different demographic characteristics and behaviors. We used a combination of published research as well as observations we have made from a network of 71 pools constructed in central New York in 2010 and monitored since then to develop objective criteria for constructing vernal pool networks to support varying population sizes of Wood Frogs and Spotted Salamanders. Here, for each species, we address aspects of site selection and pool-network layout based on current understanding of aquatic and terrestrial habitat quality and carrying capacity. At the individual pool level, we explore design strategies to mitigate undesirable outcomes such as improper hydrology and invasion by keystone predators such as breeding *L. clamitans* (Green Frog). Although vernal pool construction is in its infancy, we contend that it holds promise as a restoration and wildlife management technique under specific circumstances that can only be articulated in the context of solid understanding of natural history.

Wed-PM2-B-2

Bumble Bee Health in Agroecosystems

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Abstract - *Bombus* spp. (bumble bees) are key wild pollinators in Northeast crops, but here and worldwide, they are in decline. Our long-term studies in cranberry systems show that several *Bombus* species are shrinking severely, raising concerns that these small populations may be more vulnerable to stressors posed by the agricultural environment, including pesticides and pathogen spillover from managed pollinators. Our landscape-scale studies of virus spillover from managed honey bees in Maine *Vaccinium angustifolium* (Lowbush Blueberry) and Massachusetts cranberry crops showed that in wild *Bombus*, honey bee viruses were widespread when foragers co-occurred with honey bees and were comparatively absent in natural settings. Further, for *Bombus* species in decline, we found that parasite loads (of the trypanosome species *Crithidia*) were higher and that susceptibility to spray applications during bloom was greater when compared to a common species that is sharply increasing in abundance. Taken together, our results raise concerns regarding the resilience of *Bombus* and point to a future of greater, and fairly rapid, *Bombus* homogenization.

Wed-AM1-B-3

Where the Calcicoles Are

Scott W. Bailey (USDA Forest Service, North Woodstock, NH; swbailey@fs.fed.us)

Abstract - The influence of substrate lithology on the distribution of many vascular and non-vascular plants has long been recognized, especially in alpine, sub-alpine, and other rocky habitats. In particular, plants have been classified as dependent on high-calcium substrates (i.e., calcicoles) based on common restriction to habitats developed in calcareous rocks, such as limestone and marble. However, the actual pH range or concentrations of calcium that bound the occurrence of such plants are rarely measured. Furthermore, seemingly anomalous occurrences of calcicole plants on non-calcareous substrates are not infrequent. As a case study, the flora, bedrock, soil, and water composition of a site on Mont de la Table in the Chic-Choc Mountains of Quebec was studied. In a classic paper on the influence of substrate on plants, M.L. Fernald singled out this site for its unusual co-occurrence of calcicole and calcifuge plant taxa. In the present study, no calcareous rocks were found on-site. However, partly calcareous rocks were found further up the mountain. The highest dissolved calcium concentrations and pH in surface waters were found in a series of springs that presumably deliver groundwater influenced by calcareous rocks up slope. Within the habitat delineated by common occurrence of calcicole species, available soil calcium varied by a factor of five and pH varied by almost 1.5 units, depending on micro-topography and relative connection with groundwater. The fine-scale diversity of habitat rather than plasticity in plant tolerances appears to be responsible for co-occurrence of calcicole and calcifuge species. Similar patterns were found at other sites across the northeast, suggesting that the variable interactions of water, rocks, and soil lead to conditions suitable to colonization of calcicole plants on a broad variety of rock types, and with varying patterns of admixtures of calcium-enriched and more acidic, calcium-poor habitats.

Tue-AM2-C-3

Lessons in Urban Ecology from a Long-term Study in Ohio

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Abstract - Data collection in the Rodewald Urban Ecology System started in 2001 in riparian forests along an urban-to-rural gradient in central Ohio. This system has examined migratory and resident bird communities, native and invasive plants communities, brood parasites, and predator communities while taking into account demographics (annual survival, nest success, population dynamics), vegetation (structure, phenology, exotic/native, interactions), habitat selection (heterospecific attraction, settlement), condition (plumage, body size), juvenile ecology (movement, dispersal, post-fledging survival), and conservation planning. Ongoing research in this system has already generated 30 peer-reviewed publications, and in this talk I will highlight how I became involved in 2001 and present some key findings from this urban system since that time. In particular, we found that features associated with habitat use by *Empidonax virescens* (Acadian Flycatcher) differed at multiple spatial scales (i.e., landscape to local to microsite). Although habitat use was associated with arthropod abundance and vegetation structure at small spatial scales, the amount of urbanization in the landscape best explained Acadian Flycatcher abundance across riparian forests. In addition, the amount of urbanization in the landscape was negatively related to numbers of Neotropical migrants and positively related to numbers of resident and short-distance migrants. Furthermore, from subsequent studies, I will present findings related to 1) the impacts of exotic plants on the breeding bird community and 2) the composition and consequences of the predator community in the context of the amount of urban development in the landscape.

Tue-PM2-D-2

Alien Species, Land Use, Climate Change, and the Flora of Worcester County, Massachusetts

Robert I. Bertin (College of the Holy Cross, Worcester, MA; rbertin@holycross.edu)

Abstract - I analyzed changes in the vascular flora of Worcester County, MA, between the mid-1900s and the early 2000s. Current floristic data came from a recent survey of the county, and historical data were obtained largely from herbarium collections, especially a county-wide survey by the Hadwen Botanical Club in the 1930s to the 1950s. Established non-native species have increased and now comprise 21–36% of the flora in different towns. Frequency of non-native species is associated with proportion of land in residential use. Increasing non-native species are disproportionately non-European ornamentals, while the relatively few declining non-native species are more likely to be of European origin, agricultural weeds, and/or with a history of herbal or culinary use. The most conspicuous land-use changes have been a decrease in fields and pastures and an increase in disturbed land. In parallel, native species of fields have declined and those of ruderal habitats have increased. Spring temperatures have increased over the past 60 years, which has been accompanied by earlier flowering, especially among early season species. Northern species have decreased relative to southern species, with losses most evident in the southernmost towns in their ranges. Southern species, in contrast, are not obviously spreading northwards. This difference in behavior of northern and southern species may reflect the fact that range extensions depend on dispersal mechanisms, which can be slow, whereas range retractions reflect unsuitability of conditions, which can occur more quickly. Several families and genera had high rates of species decline, and some of these, including the Orchidaceae, Ophioglossaceae, Orobanchaceae, and Violaceae, have shown high rates of loss or decline elsewhere in the Northeast. Hypotheses for the decline of different groups include ecological succession, active eradication efforts, browsing by deer, and activities of introduced earthworms. Two declining families (Orchidaceae, Ophioglossaceae) have juvenile stages dependent on fungi. Species introductions and changes in climate and patterns of land use are likely to continue and perhaps accelerate, leading to further changes in the flora and posing challenges for conservation of biodiversity.

Tue-PM1-C-4

Differences in Microbiome Structure and Activity Between Forest and Recently Disturbed Soils from the Harvard Forest and the Quabbin Reserve

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Abstract - Terrestrial ecosystems play a major role in controlling and steering the flow of the carbon cycle. Three quarters of the carbon in terrestrial ecosystems is found as organic matter in soils, most of which is derived from plants. Microbial digestion of plant detritus forms the basis for carbon transformations in soil, yet the complex relationships between plants and diverse soil microbes are not well understood. The ability to predict rates of substrate utilization, sequestration of stable organic molecules, and the release of greenhouse gases such as carbon dioxide and methane, which impact climate, depends on a deeper understanding of the interactions between microbial community members, their utilization of plant detritus, and subsequent feedbacks on plant growth. Our ability to understand carbon cycling by microbial communities is being transformed by rapid advances in nucleotide sequencing technology, since DNA can be used to identify which microbes are present, and RNA can tell us which are active at a particular time. In order to understand how communities differ, we have developed strategies to effectively integrate computational analyses of species diversity and microbial function. Analyses will be presented of microbiome data from National Ecological Observatory Network (NEON) prototype experiments at the Harvard Forest and in the Quabbin Reserve with an emphasis on differences between soil microbial communities in forest, shrubland, and recently disturbed sites.

Wed-PM1-B-1

Demographic Mechanisms Underlying Invasive Spread: Comparison of an Invasive and its Native Ecological Analog

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Abstract - Knowledge of a species range limit is important when triaging for non-native invasive species management. With invasive species, we often have limited data at the early stages of invasion as species are not at equilibrium. These species may be beyond eradication or control by the time enough demographic data are collected. Inferring population dynamics based on current locations of invasive populations may under- or over-estimate population growth rates and, thus, potential spread. Understanding how environmental variation affects demographic parameters is important in determining species range limits and to providing a mechanistic basis for understanding invasions. Mechanistic models increase our confidence when extrapolating population-level patterns to a new set of conditions or novel landscape. We investigated establishment dynamics of a non-native invasive species, the woody *Berberis thunbergii* (Japanese Barberry), and a native ecological analog, *Lindera benzoin* (Northern Spicebush). We used integral projection models (IPMs) to predict potential establishment risk across an environmental gradient found in New England for both species. The IPMs allowed us to combine multiple relatively short-term data sets to estimate demographic patterns. We highlight conditions where natives and invasives perform similarly and where the invasives clearly outperform the natives. In general, the invasive species are less sensitive to climatic factors and are primarily limited by local habitat factors such as canopy closure. The mechanistic understanding allows us to scale up the geographic distribution to a regional level and to project potential population expansion to novel regions outside the current distribution of the species. Our results provide evidence that *B. thunbergii* is dispersal limited and has the ability to survive, grow, and reproduce in areas outside its current distribution. Sensitivity analysis suggests that management techniques may need to vary by region based on the environmental conditions found. This method allows us to take a mechanistic approach and use data available on non-native species to highlight potential areas of concern for both researchers to collect more data and for land managers to design specific management plans.

Wed-PM1-C-2

Population Ecology of Street Trees: A Citizen Science Approach

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Abstract - Urban forests provide essential ecological, economical, and psychological benefits for urban dwellers. With urbanization increasing around the globe, we urgently need to better understand how trees respond to the stresses of the urban environment. We established a citizen-science program with a dual aim to engage local citizens in scientific research and to assess the demography of street trees in Cambridge, MA. We combine data provided by the City of Cambridge with data collected by 85 citizen-scientist participants from 6 one-day expeditions. Between 2007 and 2013, the city of Cambridge planted 1850 individual trees, comprising at least 53 species from at least 20 families. Overall survival rate was over 90% for the first three years after planting, but dropped to 73% by the fifth year after planting. Street-tree survival rates were equivalent among species native to New England and non-native species (log-rank test: $P = 0.09$). Among the 15 most commonly planted species, *Acer rubrum* (Red Maple), *Quercus palustris* (Pin Oak), and *Tilia cordata* (Little-leaf Linden) were among the best-surviving species, whereas *Amelanchier arborea* (Downy Serviceberry), *Malus* spp. (crabapple), and *Syringa reticulata* (Japanese Tree Lilac) were among the worst survivors. The City of Cambridge planted trees between April and November, but most commonly in May or November. However, survival rates were highest for individuals planted between June and September. We recommend restricting planting to the summer months, and planting fewer of the poor-surviving species in the future. The citizen scientists enjoyed their experience and felt more connected to the natural world after participating in our program. Our program benefits scientists, municipalities, and citizens alike. In the future, we aim to expand this citizen-science program to other cities.

Tue-AM1-D-5

Columbia County, NY, Landscapes from the Perspectives of Plants, Ants, and Farms

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Abstract - About 80 years ago, the late Rogers McVaugh roamed Columbia County, creating one of the best of New York State's local floras. For the past 10 years, we have been building on McVaugh's work. Our goal has been both to explore some of the ecological patterns that McVaugh suggested and to develop ways of sharing those findings in publically accessible ways. We'll share some preliminary insights from our on-going county-wide surveys about the distribution of plants and ants, and briefly describe how we hope to share this information through a county-scale cultural and ecological field guide. Participatory research with County residents is helping us understand the diverse views people have of the landscape. Lastly, we'll touch upon work we have begun on a related aspect of landscape context: the role of wild species and their habitats in supporting low-input local agriculture. We have been working with agroecologists to describe the ecological interchange between cultivated and uncultivated lands. Wild nature and human use (such as agriculture) coexist in the County; our hope is to help people understand and so value wild nature for its own worth, while exploring aspects of its possible synergies with human undertakings.

Wed-PM1-D-1

Relationship Between Estuarine Breeding Bird Populations and Eutrophication on Long Island, NY

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Abstract - Predatory bird populations are representative of the upper trophic levels in ecosystems, and are often sensitive indicators of ecosystem function. Piscivorous birds in particular have been heavily studied as indicators of fish stocks. While seabird reproductive success has been related to natural plankton blooms and the prey species that the blooms support, the nature of any trophically mediated interaction between seabirds and anthropogenic nutrient sources in estuaries remains unclear. We investigate correlations between nutrients and nesting bird populations associated with the estuaries of New York Harbor and Long Island, NY, one of the most heavily populated urban and suburban regions. Data from the New York State Breeding Bird Atlases and the Long Island Colonial Waterbird Surveys were compared with water-quality data from the same region. The grid system used in the breeding bird atlases was superimposed over the interpolated nutrient data and colony locations. Water-quality data from several sources were converted to comparable units and spatially interpolated using ESRI ArcMap to provide an estimate of relative nutrient availability within the water of the grid cell. Both the estuarine bird diversity and the breeding-pair numbers within cells were then compared with the nutrient levels using statistical methods. We found that the highest diversity of estuarine breeding birds was associated with moderate to high nutrient availability within the nutrient ranges of coastal Long Island. Spatial trends associated with nutrient levels were seen in the total breeding pairs of various estuarine birds found within the grid cells during the colonial bird surveys. These results seem to be similar to published associations between the breeding success of upper trophic level seabirds to natural phytoplankton blooms. These results may also lend support to reported negative effects to some upper trophic level species that has been associated with nutrient reductions.

Tue-PM2-A-3

“If you’ve seen one tree ..”: The Diversity of Herbivores in Experimental Native and Non-native Tree Communities

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Abstract - The impact of non-native plant invasions on ecosystems is controversial because obvious local effects have not yet led to the global extinction of any native plant species on continents and large islands. However, plant diversity is not the only relevant metric for assessing the impact of non-native species; plants also sustain important local food webs of arthropod herbivores. In addition, the impact of non-natives may not be similar across arthropod feeding guilds and life stages. To examine these questions, I will present results from a large-scale (50 species) replicated common garden experiment that manipulated the composition of the first trophic level in Delaware and Pennsylvania. After an establishment year, we sampled herbivorous arthropods supported by each plant species and classified them by herbivore species, feeding guild, and life stage. We compared arthropod herbivore abundance, diversity, and feeding guild on native trees (species with evolutionary histories within local food webs) and non-native trees (species without such histories). We also compared the impact of non-native plants that are congeners of local native species with those of non-natives with no close local relatives. We found significant differences in the composition of herbivore communities on native trees versus non-native trees, and suggest that novel ecosystems comprised of plant species with no evolutionary history with local members of higher trophic levels may reduce the diversity and complexity of local food webs. Using more native plants within human-dominated landscapes may help maintain the integrity of arthropod communities as well as the populations of animals that consume arthropods.

Wed-PM1-A-4

Quantifying New York Diamondback Terrapin Habitat

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Abstract - *Spartina* marshes (*S. patens* [Salt Meadow Cordgrass] and *S. alterniflora* [Saltmarsh Cordgrass]) are typically critical foraging, nursery, and overwintering habitats for *Malaclemys terrapin* (Diamondback Terrapin). However, the relationships between *Spartina* marsh quality, quantity, and distribution and resulting Terrapin distribution, abundance, and movements are very poorly understood. To develop a model for predicting Terrapin habitat quality we need a way to prioritize the efforts needed to collect data for model building. As an initial effort, we propose using the available data on New York *Spartina* salt marsh distribution and available estimates of Terrapin home range (mostly from the southern US) to identify marshes for initial Terrapin surveys and for pilot work on habitat quality. Terrapin home ranges (95% MCP) can range up to 742 ha, but most are 54–126 ha. While long-distance movements of up to 8.5 km have been reported, a large New Jersey study reported that the maximum distance moved by most adult female Terrapins was about 722 m, which if assumed to be a range diameter implies a 41-ha range, or if assumed to be a range radius implies a 168-ha range. We present results showing New York locations where 50%, 75%, and 100% of hypothetical 50-ha and 90-ha home ranges consists of *Spartina* marsh, and thereby identify New York locations most likely to harbor Terrapins for habitat-quality studies, as well as two additional strata for testing habitat availability as a factor.

Tue-AM2-B-2

Effects of Deer Exclosures on Small Mammal Populations and Invertebrate Diversity: Preliminary Results

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Abstract - An older *Odocoileus virginianus* (White-tailed Deer) exclosure and its adjacent control plot were established in 1995 and a newer one in 2011. Parts of the new exclosure and control plots contained logging slash. A preliminary capture-recapture study of small mammals revealed a positive exclosure effect for *Tamias striatus* (Eastern Chipmunk), but no such effect for *Peromyscus leucopus* (White-footed Mouse). *Sorex cinereus* (Masked Shrew) preferred the newer slash-rich sites, and *Blarina brevicauda* (Northern Short-tailed Shrew) were found more in the newer control plot. Invertebrate abundance was greatest in the old control plot, and invertebrate diversity was greatest in the new control plot. The most commonly captured invertebrate groups were Arachnida – Aranae (Spiders), Diplopoda (Millipedes), Orthoptera: Acrididae (Short-horned Grasshoppers) and Tettigoniidae (Long-horned Grasshoppers) and Coleoptera: Staphylinidae (Rove Beetles), and Carabidae (Ground Beetles). Preliminary indications are that relative *P. leucopus* and shrew abundances were not determined by invertebrate availability.

Wed-PM2-C-3

Screening Amphibian Populations in Oswego County, NY for Infectious Ranavirus

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Abstract - Ranavirus is an emergent viral disease that has had a major impact on amphibians, fish, and reptiles. The objective of this study was to determine whether this virus is present in amphibian populations within Oswego County, NY. DNA was extracted from amphibian toe or tail clips followed by PCR targeting a portion of the ranavirus major capsid protein. Between April 2012 and October 2013, we examined 226 amphibians, including specimens from ten different species. During the first year, 25% of amphibians were positive for the virus. Ranavirus was found in 20.4% of *Rana clamitans* (Green Frog), 40% of *Eurycea bislineata* (Two-lined Salamander), 16.7% of *Rana catesbeiana* (Bullfrog), 20% of *Pseudacris crucifer* (Spring Peeper), and in the single *Rana pipiens* (Northern Leopard Frog) that was tested in 2012. Additionally, a larger percentage of amphibians tested positive for ranavirus in the later part of 2012. In contrast, a larger percentage of amphibians were infected with ranavirus in the beginning of 2013, with a total prevalence of 22.8% across three field sites. Among these, 60% of Bullfrogs were positive, along with 30.3% of Green Frogs, 25.0% of Two-lined Salamanders, 20.0% of Leopard Frogs, and 12.5% of *Rana sylvatica* (Wood Frog). This study is the first time ranavirus has been detected in Oswego County, and it seems to have remained stable at a fairly high prevalence during our period of sampling.

Tue-PM1-B-4

The Efficacy of Using Citizen-Science Aquatic Macroinvertebrates Water-Quality Monitoring in the Charles River Watershed (Massachusetts)

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Abstract - Since 1995, the Charles River Watershed Association (CRWA) has successfully employed citizen scientists to collect water-quality samples and take depth and temperature measurements on a monthly basis. This program is an integral part of the Charles River cleanup success by helping to locate major pollution sources, track restoration efforts, and measure seasonal and weather influences on water quality. In a time of shrinking budgets, it is challenging to find funds simply to maintain this program, let alone expand and sustain it. However, in 2013, CRWA was able to add a low-cost, sustainable biological monitoring component to our existing volunteer program through a successful partnership with the Freshwater Ecology Lab at the University of Massachusetts Boston (UMB). By capitalizing on CRWA's strong network of volunteers, intimate knowledge of the watershed, and deep background in water-quality investigation and UMB's technical knowledge and expertise in biological monitoring, our team was able to use minimal resources to establish a program that can successfully be maintained by CRWA. The goal of this study was to assess the water and habitat quality using the citizen-science-level SBI, expert-level Invertebrate Community Index (ICI), and the EPA Rapid Bioassessment Protocol for Habitat at 10 sites in wadeable streams of the Charles River Watershed, MA, representing a range of land-use and rural to urban gradient. Overall, six sites had "excellent" water quality, two sites had "good" water quality, and two sites had "fair" water quality based on the SBI. Meanwhile, the ICI indicated that one site was "not impacted", one site was "slightly impacted", and eight sites were "moderately impacted". A regression comparing ICI versus SBI scores revealed a positive, but not statistically significant ($P > 0.05$) relationship. Furthermore, the EPA Habitat assessment indicated one site had "optimal" habitat quality, four sites were "sub-optimal" habitat quality, and five sites had "marginal" habitat quality. Based on our study, we reached two conclusions. First, overall water quality averaged "good" or "slightly impaired" in the watershed. Second, there is a possible positive correlation between the volunteer and professional indices and with a larger sample size, a statistically significant relation may be seen, thus indicating that citizen-science efforts could be an economically feasible option to monitoring water quality in the watershed.

Tue-PM2-B-4

Fidelity and Persistence of Ring-billed and Herring Gulls to Wintering Sites

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Abstract - While the breeding ecology of gulls has been well studied, the movements and spatial organization of gulls during the non-breeding season is poorly understood. We studied the seasonal movements, winter-site fidelity, and site persistence of *Larus delawarensis* (Ring-billed Gull) and *Larus argentatus* (Herring Gull) to wintering areas during 2008–2012. We deployed 21 satellite transmitters on Ring-billed Gulls and 14 on Herring Gulls and tracked 10 Ring-billed and 6 Herring Gulls over multiple winters. We also followed >300 wing-tagged Ring-billed Gulls to determine winter-site fidelity and persistence. Home-range overlap for individuals between years ranged 0–1.0 (95% minimum convex polygon) and 0.31–0.79 (kernel utilization distributions). Gulls remained at local wintering sites during the non-breeding season 74–161 days (Herring) and 20–167 days (Ring-billed). Most Ring-billed Gulls used more than one wintering location, while Herring Gulls used only one. The probability of a tagged Ring-billed Gull returning to the same site in subsequent winters was high; conversely, there was a low probability of a gull returning to a different site. Results from this study provide evidence that Ring-billed and Herring Gulls exhibit high winter-site fidelity but variable site persistence during the winter season, leading to a high probability of encountering the same individuals in subsequent winters.

Wed-AM1-D-3

Settlement-Era Forests of New England: The Empirical Data

Charles V. Cogbill (Harvard Forest, Petersham, MA; cvcogbill@gmail.com)

Abstract - The land division surveys from European settlement in the Northeast provide unique quantitative documentary evidence of the region's forests. I have located and collated early (1640–1850) survey records from across New England. This database covers over 590 individual town-scale units containing 185,370 individual witness-tree citations. Overall, boreal conifers, northern hardwoods, temperate conifers, and central hardwoods formed 8%, 27%, 16% and 38%, respectively, of the trees in New England forest at settlement. The tree abundances were summarized into genera, the vegetation types were classified, and the variations were further elucidated by geospatial analysis. A distinct and narrow tension zone extended across central New England separating the northern hardwood forest dominated by beech from the central hardwoods dominated by *Quercus* spp. (oaks) to the south. The northern conifer (*Picea* spp.[spruce] and *Abies* spp. [fir]) forest blended along a wide mixed conifer-hardwood transition forest to the south and was only secondarily delimited as a zone across northern New England. The oak forest, mixed in places with *Pinus* spp. (pine), had prominent extensions up the major river valleys. These oak forests were certainly linked to fire disturbances and probably connected to native American populations. Although undergoing drastic changes in species abundances, alteration of forest disturbance processes, and major changes in climate, the presettlement character and position of the New England tension zone has not changed over the past 200 years.

Tue-PM1-C-1

Cryptic and Under-detected Hybrid Vascular Plant Taxa in Southern New England

Bryan A. Connolly (Massachusetts Natural Heritage & Endangered Species Program, Division of Fisheries and Wildlife, W. Boylston, MA; bryan.a.connolly@state.ma.us)

Abstract - Recent botanical field inventories have revealed that many plant hybrids in southern New England are more common than previously believed. Additionally, several previously unknown hybrids have been documented. Such hybrids include members of the genera *Aronia* (chokeberry), *Berberis* (barberry), *Celastrus* (bittersweet), *Euphorbia* (spurge), *Fallopia* (knotweed), *Juglans* (walnut), *Populus* (poplar), *Robinia* (locust), and *Rhamnus* (buckthorn). Hybrid taxa in *Berberis*, *Fallopia*, *Juglans*, and *Populus* appear to be quite common and distributed over large geographic ranges. All hybrids discussed here involve species not native to southern New England. Parental taxa of the different hybrids vary in their origins, including the combinations: southern New England native × Eurasian, Eurasian × Eurasian, and non-southern New England North American × non-southern New England North American. *Aronia melanocarpa* (Black Chokeberry), a southern New England native, has been found to hybridize with the Eurasian *Sorbus aucuparia* (European Mountain Ash) forming the intergeneric hybrid ×*Sorbaronia fallax*. The ecological and genetic repercussions of these hybrids are not known and little studied. The fertility of many of the hybrids is unknown, though *Juglans* and *Aronia* hybrids appear to freely set seed, while *Celastrus* crosses show low reproductive competence, and *Berberis* hybrids seems to have intermediate reproductive success. Further investigation is needed to better understand the frequency and distribution of these hybrids, and to assess their impact on the ecology of southern New England.

Tue-PM1-C-3

The Snail Wrangler: Filling the Gaps in Land Snail Awareness and Education

Marla L. Coppolino (Paleontological Research Institution, Ithaca, NY; Delaware Museum of Natural History, Wilmington, DE; marlacoppolino@gmail.com)

Abstract - Land snails are a typically understudied and underappreciated group of fauna. Educational materials and presentations for the general public that feature animals tend to focus on the more-recognized “charismatic megafauna” including mammals, birds, reptiles, and amphibians, as well as insects and fish, with land snails scarcely receiving a mention, if discussed at all. Popular animal-conservation campaigns also uphold this bias. The trend of land snail omission can be observed in their non-appearance in educational books, posters, toys, and even as images on clothing and accessories. Native land snails should not be overlooked, since they occupy a low level of the food web, glean essential nutrients from decaying vegetation and soil and thus support the vitality of the more “popular” animals that require them in their diets for survival. This dearth of recognition of the importance of land snails underscores the issue of poor ecological literacy among lay audiences. To address the gaps in land snail awareness, I started a new sole proprietorship called The Snail WranglerSM. Its main purpose is to promote awareness about the importance of land snails in the ecosystem to general audiences of all ages. When land snails are brought into the public eye through my educational multimedia presentations, materials, and promotion of their appearance as beautiful animals in popular media and merchandise, land snails are then appreciated and respected for their beauty and vital role in a healthy ecosystem. Feedback thus far has been very positive.

Tue-AM2-D-2

Novel Ecosystems in Heterogeneous Urban Forests

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Abstract - The FRAME program (Forest Fragments in Managed Ecosystems) is a long-term study of forest fragments along a gradient of urbanization. One of the main goals of FRAME is to explore multitrophic interactions in the novel ecosystems created by nonnative plant invasion. To facilitate this research, we established 30 sites and quantified soil macro- and micronutrients, vegetation structure and composition, invertebrate biomass, herpetofauna occupancy, and avian density and reproductive success. The most commonly occurring invasive plant in our Mid-Atlantic FRAME sites is *Rosa multiflora*, an Asiatic species once widely planted as a refuge for wildlife. Preliminary data from other sites in Delaware showed significant differences between Ca-rich invertebrates such as snails and isopods, soil pH, and soil Ca:Al beneath *R. multiflora* shrubs and those at locations with native plants or leaf litter. We attempted to verify these results with an expanded study in FRAME including a number of key species in various trophic strata. The presence of *R. multiflora* in the 30 Mid-Atlantic FRAME sites was positively and significantly correlated with higher levels of soil calcium, greater numbers of *Dumetella carolinensis* (Catbird) territories, and greater numbers of Ca-rich prey. Over 40% of Catbird nests found in our sites were in *R. multiflora*, and 46% of Catbird nests in that habitat successfully fledged young. Historical data from one of our sites (from the 1960s) shows that invasion by *R. multiflora* has occurred over the past 50 years. It also reveals a suggestive change between territory numbers for *Hylocichla mustelina* (Wood Thrush)—a species that avoids urban areas and does not nest in *R. multiflora*—and Catbird territory numbers. Other interactions seen, such as those between leaf-litter volume and nonnative plant invasion, indicate the need for future research on interactions between nonnative earthworms and invasive plants.

Tue-PM2-D-3

Animal-Facilitated Dispersal of Bryophyte Spores in Northeastern US Forests

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Abstract - Bryophytes are ubiquitous features of northeastern US forests. Our understanding of their dispersal patterns, however, is limited. Bryophyte-animal interactions in particular form an exceedingly small portion of the literature on this topic. The objective of this study was to determine the potential role of small mammals in the dispersal of bryophytes via endozoochory. We trapped 77 rodents at three forested sites in central New York and collected 6 fecal pellets from each. Pellets were stored in 500 μ l of deionized water at 4 °C. To detect the presence of spores, bryophyte material was separated out of fecal samples using density centrifugation and examined under a light microscope. Additional fecal material was sterilized and cultured on a nutrient agar to test for spore viability. As a comparison to field collections, 20 sporophytes and associated gametophytic material of two bryophyte species (*Dicranum flagellare* and *Polytrichum commune*) were fed to each of 18 laboratory mice in two separate experiments. Three-pellet samples were collected every 24 hours for a period of 4 days resulting in a total of 72 samples for each bryophyte species (18 mice x 4 days = 72 samples). We performed the same fecal observation and culturing techniques used with the field-collected samples. An average of 1626 spores per 3-pellet sample were detected in the field collections. An average of 28 *D. flagellare* spores and 4333 *P. commune* spores were found in the laboratory samples, with a significantly greater number of spores in day 1 samples compared to days 2–4. Bryophyte growth, defined as a germinated spore, was found in 1.4% of *D. flagellare* samples and 40.3% of *P. commune* samples. No growth from spores was observed in the field samples. Our results indicate that rodents do consume bryophytes and that bryophyte spores are able to remain viable after passing through the digestive tract of mice. While the field plates did not yield bryophyte growth, the abundance of spores in these samples shows that they are being consumed. This study provides evidence of the potential role that rodents play in the dispersal of forest bryophytes.

Wed-PM1-B-3

From Southeast to Northeast: Connecting Nature at a Continental Scale

John Davis (Westport, NY; Wildlands Network; john@wildlandsnetwork.org)

Abstract - In the coming century and beyond, connectivity, at continental scales, will become increasingly important. Any region whose wildlands are not connected to others may be at risk of species loss. Continental-scale is often talked about, but rarely studied in the field. In 2011 and 2013, John Davis attempted to do so, trekking some 12,000 miles through North American ecosystems in the East from the Florida Keys to Quebec's Gaspé and in the West from the Sky Islands in Mexico to British Columbia. Along the way he met with, and often was guided by, scores of biologists, naturalists, and conservationists. Out of these treks, several evident themes have emerged: the clear possibility of an Eastern Wildway, the limited time that remains in which to create it, and the critical roles that private land stewardship and the restoration of predators, particularly *Felis concolor* (Eastern Cougar), will need to play if it is to be accomplished. This talk will describe John's eastern trek, discuss the importance of predators and connectivity to eastern forests, and explain what an Eastern Wildway would look like and how it could be created.

Wed-PM1-D-3

Assessing Cumulative Ecological Degradation from Marcellus Shale Exploitation in NY: A GIS Model

John B. Davis (Sage College of Albany, Albany, NY; davisj5@sage.edu) and **George R. Robinson** (State University of New York at Albany, Albany, NY; grobinson@albany.edu)

Abstract - When natural resources are exploited, environmental costs and economic benefits are often asymmetric. In the public debate about the costs and benefits of hydraulic fracturing in New York State, relatively little attention has been paid to broader ecological impacts beyond individual drilling operations. We developed a GIS-based model, built on a hexagonal-grid underlay nested within the US EPA EMAP system, to examine potential cumulative statewide ecological impacts. In a two-step process, we characterized >19,000 hexagons, each sized to approximate the footprint of one drilling site (2.57 km²), using ecological attributes, then developed a method for apportioning resource access that includes assessments of cumulative ecological costs. Over one-fourth of the hexagons were excluded as off-limits on the basis of six criteria: slope suitability, regulated wetland cover, length of high-quality streams, mapped road density, and open-water cover. Three additional criteria—densities of grassland birds (North American Breeding Bird Survey), percent core forest (Coastal Change Analysis Program), and total density of all state-mapped streams—were determined and used in combination to assess estimated ecological vulnerability of the remaining sites for the purpose of ranking the 14,000 potentially accessible sites. In a second step, an iterative process was used to distribute potential site access among all towns (sub-county governments) within the Marcellus shale formation. At each iteration, one site is selected per town, whether randomly, or in rank order of increasing vulnerability. Results were computed as percent cumulative ecological impact versus number of sites committed, and compared with a most-conservative selection process (ranked by statewide vulnerability). Random selection with proportional distribution by town resulted in larger cumulative ecological impacts, but rank-ordered selection by town was in many ways comparable to selection by statewide vulnerability ranking. These outcomes allow for a political solution for managing resource access fairly, based on a balanced geographic distribution of economic benefits, coupled with an underlying scientific basis for assessing the ecological costs that are publicly shared. Potential applications include permit fees (or comparable instruments) set on a sliding scale to match cumulative ecological impacts.

Tue-PM1-A-2

Deer Impacts on Northeastern Temperate Forest Bee Communities

Caroline M. DeVan (NJ Institute of Technology [NJIT], Newark, NJ; cmd26@njit.edu) and **Daniel Bunker** (NJIT, Newark, NJ; dbunker@njit.edu)

Abstract - *Odocoileus virginianus* (White-tailed Deer) are increasingly overabundant in northeastern temperate forests. They have a large impact on plant communities, herbivorying early spring annuals as well as young woody plants. As large deer populations modify the plant community, other organisms are affected through trophic cascades. We hypothesize that deer are negatively impacting bees by removing the floral resources. To test this hypothesis, we have been sampling bee communities near deer exclosures and away from deer exclosures at Morristown National Historical Park in Morristown, NJ, using pan traps known as “bee bowls”. Deer exclosures have been built in many parks throughout the northeastern temperate region as a means of restoring forests and as a part of research efforts to understand deer-herbivory impacts. Preliminary results from our first year of sampling indicate that deer exclosures are highly variable in floral resources and do not consistently contain more flowering plants than control sites. As a result, there are not statistically significant differences in richness or abundance of bees between sites near deer exclosures and sites further away.

Wed-PM2-A-2

Influence of Canopy Phenology on Invasive Plant Success in Temperate Forest Understories

Lindsay M. Dreiss (Dept of Natural Resources, UConn, Storrs, CT; lmdreiss@gmail.com) and John C. Volin (Dept of Natural Resources, UConn, Storrs, CT; john.volin@uconn.edu)

Abstract - Invasive exotic species (IES) pose a serious threat to ecosystem structure and function worldwide, but the causes for IES success in introduced environments are often unclear. In temperate forests of eastern North America, the ability of IES to colonize understories is notable given the intense competition for light and other resources. One of several widely cited mechanisms facilitating invasion is an extended duration of annual photosynthetic activity in IES foliage, due to early leaf flush in the spring and/or delayed autumnal senescence. However, the amount of “extra” light harvested by IES foliage is determined in large part by overstory canopy phenology, which varies considerably among tree species. We assessed IES presence in interior, intact temperate forest understories in relation to canopy-induced environmental conditions. Five native canopy types were used, *Populus tremuloides* (Quaking Aspen), *Acer saccharum* (Sugar Maple), *Quercus* spp./*Carya* spp. (Oak/Hickory), *Fraxinus americana* (White Ash), evergreen species mix *Pinus* spp./*Tsuga canadensis* (Pine/Hemlock), along with one nonnative canopy species, *Robinia pseudoacacia* (Black Locust). Understory light availability post leaf-expansion was significantly higher under Quaking Aspen than other canopies with the exception of Black Locust and White Ash. Canopy bud break and leaf flush occurred first in Quaking Aspen stands followed by Sugar Maple, Oak/Hickory, White Ash, and Black Locust stands, respectively. As expected, soil analyses showed higher nitrate levels in the nitrogen-fixing Black Locust stands, but unexpectedly, also in the White Ash stands. Under these two canopy types, IES cover and relative abundance were significantly higher, suggesting the importance of greater resource availability in invasive plant success. As such, deciduous forests canopies with late leaf flush and comparatively short leaf duration are, on average, more extensively colonized by IES. Given the sensitivity of plant phenology to variation in climate, and the inevitability of further climate warming, pronounced phenological responses to future climate change will likely have important implications for the susceptibility of temperate forest understories to IES.

Tue-AM1-C-2

Continental-scale Impacts of Climate Change on Runoff

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Abstract - Understanding the impacts of changes in climate and land use on ecohydrologic processes in a watershed is vital in the development of water-resource policies for sustainability, especially to maintain human consumptive needs and enhance ecosystem services. This study investigates how variations in climatic variables impact runoff in watershed systems using statistical and simulation modeling. Watersheds in the continental United States have diverse hydrogeomorphic characters, mean temperatures, soil moistures, precipitation, and evaporation patterns that all influence runoff processes. Our bivariate analysis showed correlation between precipitation and runoff. In linear regression models, temperature was significant in some seasonal models, but its role was minor in explaining the amount of runoff. Soil moisture was significant in influencing fall runoff. Soil moisture varied from a minimum of 266.65 mm to a maximum of 6894 mm in the study area. A 1% change in soil moisture translated to a 5% change in annual runoff. This relationship is a significant factor in influencing annual runoff in most watersheds. Changes in vegetation and the time and rate of precipitation and evaporation influence runoff. We found that low soil moisture and high temperatures influenced runoff patterns in certain regions of the US. Regions that experience less moisture and increasing temperatures can have significant changes in runoff patterns. Annual and seasonal runoff affected flooding in the many watersheds that are sensitive to small changes in climatic variables. Our findings indicate that changes in climate can affect runoff depending on soil moisture, evaporation, precipitation, and vegetative patterns. Runoff-reducing strategies include reducing impervious cover, increasing open space, implementing best-management practices, and utilizing “green” infrastructure. Nonstructural practices like education, incentive policies, and information provision are vital to reduce the impacts of climate change on runoff.

Wed-AM1-D-2

Timing of Peak Acorn Yield in Northern Red Oak at Flatrock Forest in Relation to Small Mammals

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Abstract - Oak trees can produce pulsed, synchronous mass-production of seeds; a phenomena coined “masting”. Among the diversity of trees in northeastern forests, mast events from *Quercus rubra* (Northern Red Oak) have been linked to wildlife demographics. In years of surplus, oak species may satiate granivores and thus enhanced germination rates occur in those years. Variation in annual seed yield within populations of Northern Red Oaks has been well studied. However, we sought to better understand the within-year timing of peak sound acorn maturation from a population of Northern Red Oaks near their northern range limit in upstate New York. Further, we compared the timing of sound acorn maturation with small-mammal trapping data. To measure this dynamic, we installed ten seed traps and then monitored them weekly from September 10th to October 9th 2013. We collected acorn yield (i.e., seed traps) and on-the-ground abundance data, and compared it with small-mammal presence. The peak seed rain of sound acorns, as well as the maximum small-mammal captures, occurred during the week of October 9th 2013. *Peromyscus* spp. (e.g., *P. maniculatus* [Deer Mouse] and *P. leucopus* [White-footed Mouse]) were the most-captured granivore species. When compared to seed-trap data, ground plots showed signs of acorn removal most likely attributed to small mammals or other acorn predators. The number of sound acorns recorded in the ground plot during the final week of the study was 75% less than the cumulative number of acorns found in the seed traps during the sampling season. Acorn masting is one of nature’s phenomena that demands further investigation. Our baseline data will eventually be used to help understand the mechanics of the phenomena and will hopefully lead to optimized management practices of the valued Northern Red Oak, a foundational species within the northern hardwood forest.

Wed-PM2-C-1

Drew Mountain: A Granite Hill Plant Geography

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Abstract - Drew Mountain exhibits a typical, yet complex, plant geography of a low (589 m) granite mountain set in the northern Vermont piedmont. A largely forest vegetation includes predominant northern hardwoods combined in places with northern conifers as co-dominants or in patches. Plant distributions and abundances of over 300 vascular plant species are viewed with respect to landform, landscape position, soil depth and type, minor variations in bedrock lithology, and land-use history. While land-use history strongly influences forest composition on lower slopes, minor landscape features, such as seeps, coves, perched basin wetlands, rubble zones, and ledges with limestone inclusions produce unusual site conditions that contribute significantly to plant diversity. Based on exploration of the mountain over a 25-year period, this descriptive work is a prelude to a more extensive study of the Granite Hills range at the headwaters of the Winooski River.

Tue-AM2-C-1

Landscape Changes and Biological Communities across a Gradient of Natural Gas Activity in Streams

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Abstract - Advances in drilling and extraction of natural gas have resulted in rapid expansion of well pads and associated infrastructure in shale basins across the US. Rate of gas-well installation in the Fayetteville Shale of north-central Arkansas has been 774 wells per year since 2005 with more planned. Rapid and concentrated activity and wells placed close to streams increases potential for negative effects to aquatic biological communities. We quantified a suite of water-quality metrics at storm flow and base flow including trace elements, conductivity, and suspended sediments from spring 2009 to spring 2013. Periphyton, macroinvertebrates, and fish were quantified across the same study sites. We predicted higher concentrations of suspended sediment, conductivity, and trace elements in catchments with more gas-well activity and a concurrent decline in periphyton chlorophyll α , and sensitive macroinvertebrate and fish species. Correlations were used to explore relationships among gas activity, sediment concentrations, trace elements, and biota across study sites. Turbidity during storms was positively related to gas-well activity during six of seven storms, organic sediment was positively related to gas-well activity in two of seven storms, and inorganic sediment was positively related to gas-well activity in four of seven storms. Periphyton biomass and generalist macroinvertebrate taxa, such as chironomid midges, tended to increase in catchments with more gas-well activity; while sensitive fish taxa, such as darters, tended to decline. We will present patterns in gas activity and biological responses across streams during four spring sampling events.

Tue-AM2-A-3

Investigating Growth and Growth Form in Invasive and Native Watermilfoil Species Across a Range of Water Temperatures: Implications for Aquatic Plant Communities Under Climate Change Scenarios

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Abstract - In the Northeastern United States, predicted temperature increases of 1.4 to 2.2 °C (2.5 to 4 °F) in the winter season, and 0.8 to 1.9°C (1.5 to 3.5 °F) in the summer will be reflected in lakes as earlier ice out, warmer spring water, and higher summer peak temperatures. Few published studies have examined the effect of temperature change on aquatic invasive species growth in the Northeastern United States. We studied the physiological responses of fragments of two invasive (*Myriophyllum spicatum* [Eurasian Watermilfoil; EWM] and *Myriophyllum heterophyllum* [Variable Leaf Milfoil; VLM]) and one native (*Myriophyllum spicatum* [Northern Watermilfoil; NWM]) species of milfoil over a range of water temperatures that reflect a broad range of current and predicted water temperatures (14°C, 21°C, 24°C, 26°C, 31°C). We measured total biomass, new biomass growth, length and lateral growth, and rootlet production over a 6-week period. For all growth variables, measured values for the native NWM were significantly less than for the invasive species regardless of temperature, and were reduced in higher water temperature. Invasive EWM and VLM fragments added about the same amount of new biomass over the experiment; however, they had distinctly different response curves to temperature increases. Differences in carbon allocation appears to be important to overall fragment success. VLM fragments are very robust and maintain much of the green biomass of the initial fragment while adding some new tissue. NWM fragments are fairly fragile and maintain a fair amount of green initial biomass; however, they have very low growth rates at any temperature and grow particularly poorly at the higher temperatures. EWM essentially puts no carbon into maintenance of initial fragment biomass, but allocates the most carbon to apical and lateral growth in buds that break after fragmentation. Controlled laboratory studies are the first step in developing hypotheses about competition outcomes that might alter community composition in a future of higher summer water temperatures. These outcomes clearly suggest that the slow-growing, native NWM will be negatively affected by warmer spring water temperatures, while the invasives will benefit. Hypothesized competitive interactions between the two co-occurring invasive species are discussed.

Wed-PM1-C-4

Trace Metals and Ragweed Pollen Constrain Stratigraphy of a Sediment Core from North Cinder Island, NY

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Abstract - In an attempt to characterize trace-metal trends on the South Shore of Long Island, a sediment core 122 cm long was extracted from a site at 40.6097°N, 73.6092°W in the tidal marshland of North Cinder Island (located between Oceanside and Point Lookout, NY) on 2 July 2013. The core was split into two halves, photographed, and sampled at 1-cm resolution. Each 1-cm interval of sediment was separated into two portions: that which had been in the outer ring of the core (within a centimeter of the aluminum coring pipe), and that which was in the center of the core and unlikely to have been contaminated by trace metals from the pipe itself. Four of the outer-core samples, from core depths of 67–68 cm, 77–78 cm, 87–88 cm, and 97–98 cm, were analyzed for Pine, Oak, Hickory, Birch, Grass (*S. alterniflora* and *S. patens*), and Ragweed pollen concentrations. Nine of the inner-core samples (every ten centimeters from 0–70 cm depth, and one duplicate) were analyzed for Zinc (Zn), Lead (Pb), Copper (Cu), Iron (Fe), and Mercury (Hg) concentrations. The Ragweed concentrations were close to 10% in the 67–68 cm and 77–78 cm samples, indicating that the sediment in these depths was deposited after European settlement of the area and widespread cultivation of land for agricultural purposes. The 87–88 cm sample, however, had only a 3% Ragweed concentration, and the 97–98 cm sample was below 1% Ragweed concentration: these results indicate that the deposition of the sediment at these depths preceded European settlement in the mid-1600s. The Pb concentrations constrain the chronology of one additional depth in the sediment core. The lowest three samples are not significantly different in their relatively low concentrations, while the peak concentration of 58 ppm (ignoring the 10–11 cm sample, whose reading of 578 ppm appears to be due to contamination of some kind) is reached at 40–41 cm depth. This finding suggests the deposition of these layers near the time of peak Pb pollution, which has been estimated between 1970–1980 in Long Island's North Shore marshes. Hg concentrations also peak at 40–41 cm, at a level of 0.27%.

Tue-AM2-B-3

Bats of Long Island II: Could Coastal Plain Habitat Be a Refuge From White-Nose Syndrome?

Michael S. Fishman (Barton & Loguidice, P.C., Syracuse, NY; mfishman@bartonandloguidice.com)

Abstract - Bat surveys conducted on Long Island, NY (LI) over the past 2 years have revealed numbers of *Myotis septentrionalis* (Northern Long-Eared Bat) far in excess of numbers detected inland, despite the fact that White Nose Syndrome (WNS) was first detected on LI in 2011. WNS appears to have been delayed in reaching LI, having been detected on the mainland beyond LI by 2009. These events have raised questions about the ecology of bats on LI. Bats are known to cross water bodies in migration, so why was WNS delayed in its spread to LI? Are bats hibernating on LI, and if so, where are they hibernating, since LI has no natural caves or subterranean mines where this species is generally known to hibernate? Is the continued survival of Northern Long-eared Bats in relatively abundant numbers on Long Island an artifact of the delayed spread of WNS, or are winter conditions unsuitable for proliferation of *Pseudogymnoascus destructans*, the fungus that causes WNS? We will discuss these questions and the approach proposed to answer them.

Tue-AM1-A-5

Lights, Camera, ... Citizen Science: Assessing the Effectiveness of Video-based Training in Invasive Plant Identification

Lena Fletcher (Environmental Conservation, UMass Amherst; lfletche@eco.umass.edu), **Jared Starr** (Environmental Conservation, UMass Amherst; jstarr@eco.umass.edu), Nathan Bush (Environmental Conservation, UMass Amherst; nathanbush0311@gmail.com), Charlie Schweik (Environmental Conservation and Center for Public Policy and Administration, UMass Amherst; cshweik@pubpol.umass.edu), and Jack Finn (Environmental Conservation, UMass Amherst; finn@eco.umass.edu).

Abstract - The rapid growth and increasing popularity of smartphone technology is putting sophisticated data-collection tools in the hands of more and more citizens. The Outsmart Invasive Species Smartphone application (app) allows users to get text, image, and video information about invasive species instantly on their smartphone. Utilizing an “information commons” systems approach such as web-streaming videos to reach the critical masses, we produced invasive-plant-identification training videos to offset underprovided in-person training seminars. In our study of invasive-species monitoring through smartphone crowdsourcing, we compared three different app-user training methods to understand the effectiveness of each of the training types; (1) app-embedded species-identification text and images, (2) app-embedded species-identification training videos, and (3) formal in-person training. We focused on five invasive species common in western Massachusetts to compare user identification performance based on one of the three training methods. Results support our hypotheses that participants who do not receive in-person training, but have received video training, will perform better than text/image-trained participants. Results also indicate that video-trained participants may perform comparably to in-person trained participants. These results suggest that app-based species-identification training videos, followed by textual/image information, have the potential to fill the training gap needed to properly train citizens to identify invasive species.

Tue-AM1-D-3

The Spider Fauna of Isolated Salt Marsh Patches in the South Shore Estuary Reserve, Long Island, NY

Matthias W. Foellmer (Adelphi University, Garden City, NY; Foellmer@adelphi.edu) and Carolyn Trietsch (Adelphi University, Garden City, NY; carolyntrietsch@mail.adelphi.edu)

Abstract - Coastal wetlands such as salt marshes are highly threatened ecosystems worldwide due to land conversion for human settlement, industrial purposes, or agriculture. Healthy salt marshes sustain unique coastal communities, large numbers of migrating birds and fisheries of large economic value, and function as natural storm flood barriers. Furthermore, marine and terrestrial food webs are connected through many trophic links in the salt marsh systems, enabling the movement of nutrients as well as bio-accumulating pollutants between food webs. A good understanding of community and food-web structure in salt marshes is therefore important. Here we investigate the composition of the spider communities of three isolated salt marsh patches on the south shore of Long Island, NY. Spiders are top predators in salt marshes, with both terrestrial and semi-aquatic species present. They play a key role in the community through top-down effects and intraguild predation, and are important for the movement of pollutants from aquatic to terrestrial systems. Yet, the spider community structures in salt marshes and the factors which influence them are still poorly understood, especially in northeastern North America. We document differences in species diversity as well as in body sizes and discuss these results with respect to relevant environmental factors. This study is part of a larger project establishing base-line records for the terrestrial and semi-aquatic invertebrate fauna in the South Shore Estuary Reserve, Long Island.

Tue-PM2-A-1

Hemlock: A Forest Giant on the Edge

David R. Foster (Harvard Forest, Harvard University, Petersham, MA; drfoster@fas.harvard.edu)

Abstract - *Tsuga canadensis* (Eastern Hemlock), an iconic species of American woods and history, is disappearing from our forests as it falls to an exotic insect. Given the current state and prospective future of Hemlock, now is an appropriate time to assess and reflect on its history, its role in our woods, and the lessons that it provides to ecology, conservation, and environmental history. Drawing from a new volume compiled by Harvard Forest authors that synthesizes more than one hundred years of published research, this paper will explore the history of science and scientists that have helped define the place of this species in the New England landscape. From this exploration, comes a test of emerging ecological concepts, insights into the role of historical perspectives in addressing the challenges of managing current and future changes in the land, and a great appreciation for a forest giant that we are losing. Above all, Hemlock's lengthy history of arrival, decline, recover, and loss offers us a series of natural experiments that we can use to seek answers to fundamental questions about nature.

Tue-PM2-C-1

The Rockland Audubon Society Bluebird Trail: Developing a Successful, Small-scale Citizen-Science Project

Elyse Glover Fuller (Rockland Audubon Society, New City, NY; efuller@sunyrockland.edu)

Abstract - Establishing a bluebird trail is a popular way of involving the public in citizen science while at the same time, offering a simplified way to observe breeding behavior and record breeding success of *Sialia sialis* (Eastern Bluebird). The Rockland Audubon Society (RAS) Bluebird Trail is an example of a successful, small-scale citizen-science project that has involved dozens of volunteers and hundreds of participants over four breeding seasons. Though the RAS Bluebird Trail started as a conservation project with a goal of enhancing potential Eastern Bluebird breeding habitat with artificial nesting cavities, the project has morphed into one that is rich with environmental education and research opportunities for volunteers. The successes and challenges of this project serve as examples from which others may learn when developing citizen-science projects of their own.

Tue-AM2-D-1

Introduction to Bioeradication

Richard Gardner (rtgardner3@yahoo.com)

Abstract - This presentation explains the basics of bioeradication, the elimination of non-native plants from an ecosystem through developing systems of native and indigenous organisms. It is an introduction to the developing terminology, concepts and principles of bioeradication and its application to specific non-native invasive plants. This presentation will use *Ailanthus altissima* (Tree of Heaven) as the example of a working bioeradication system.

Wed-AM1-C-1

Bioeradication: Invasive Non-native Plants, their Weaknesses and their Eradication

Richard Gardner (rtgardner3@yahoo.com)

Abstract - The first of two focal points in this presentation are the organism systems affecting the non-native invasive plants *Ailanthus altissima* (Tree of Heaven), *Rosa multiflora* (Multiflora Rose), *Lonicera morrowii* (Morrows Honeysuckle) *Lonicera maackii* (Amur Honeysuckle) and *Lonicera japonica* (Japanese Honeysuckle). The second focal point is on the weaknesses of various non-native invasive plants and the issues which appear to be affecting them. Particular plants in this section are *Celastrus orbiculatus* (Oriental bittersweet), *Rubus phoenicolasius* (Wineberry), *Alliaria petiolata* (Garlic Mustard) and *Microstegium vimineum* (Japanese stilt grass).

Wed-AM1-C-2

The Concepts and Terminology, Theoretical Framework, and Application of Bioeradication

Richard Gardner (rtgardner3@yahoo.com)

Abstract - This third presentation focuses on the concepts, terminology, theoretical framework, and application which frame bioeradication versus biocontrol. *Ailanthus altissima* (Tree of Heaven) will be used as an example of a working bioeradicant system. In contrast, *Polygonum perfoliatum* (Mile-a-Minute) and its introduced biocontrol *Rhinoncomimus latipes* will be used as an example of a biocontrol system which has potential problems from the original targeting of this plant to the release of the biocontrol.

Wed-AM1-C-3

The Importance of Private Land for Wildlife in the Adirondacks

Michale J. Glennon (Wildlife Conservation Society, Saranac Lake, NY; mglennon@wcs.org)

Abstract - One of the most enduring debates in the Adirondacks and elsewhere concerns how much protected land we need, and how we balance development and environmental protection. I try here to provide information to contribute to this discussion. The recent Northeast Terrestrial Habitat Classification System (NETHCS) and associated map provides a consistent habitat classification for the entire Northeast, and digital data available for GIS analyses. I examined the spatial distribution of habitats in the Adirondacks, as well as their relationship to vertebrates. I find that there are some habitats well represented on New York State Forest Preserve and easement lands, others disproportionately represented on private lands, and some well represented on both. This finding suggests that the public and private lands in Adirondack Park do not protect the same features, and has important implications for wildlife. Given climate change and intense recreational pressures in some areas, we cannot be certain that state or easement protection is always adequate for protecting biodiversity, nor can we assume that private ownership always equates to a lack of protection. Private lands are home to several rare habitats that are potentially used by numerous species. Many of these rare habitats exist in small patches scattered over large areas, making Forest Preserve or easement protections on them challenging. Rather than focusing on how much is enough, we may be better served to focus on how and where we (state agencies, local communities, landowners, conservation and community organizations, recreationists, land-use planners) can best steward the unique habitats on both public and private lands so that we avoid impacts to those most critical.

Wed-PM1-D-2

Effectiveness of Head-starting as a Tool for Establishing a Viable Population of Blanding's Turtles

Jared Green (Savannah River Ecology Lab, Aiken, SC; jmg05005@uga.edu), Kurt Buhlmann (Savannah River Ecology Lab, Aiken, SC; kbuhlmann@earthlink.net), Stephanie Koch (U.S. Fish & Wildlife Service, Sudbury, MA; stephanie_koch@fws.gov), Brian Butler (Oxbow Associates, Inc., Boxborough, MA; butler@oxbowassociates.com), Brian Bastarache (Bristol County Agricultural High School, Dighton, MA; bbastarache@bcahs.com), Richard Chandler (University of Georgia, Athens, GA; rhandler@warnell.uga.edu), Nicole Gerard (US Fish & Wildlife Service, Sudbury, MA; Nicole_gerard@fws.gov), Lori Roy (Oxbow Associates, Boxborough, MA; lori@oxbowassociates.com), and Tracey Tuberville (Savannah River Ecology Lab, Aiken, SC; tracey.tuberville@gmail.com)

Abstract - *Emydoidea blandingii* (Blanding's Turtle) occurs in 15 states and has protected status in all of them. With the possible exception of a single population, sites where Blanding's Turtles exist in Massachusetts likely do not represent long-term viable populations under current conditions. Therefore, simply proposing to protect existing sites may not be enough to maintain this species as a viable component of the New England landscape. To counteract shrinking populations, a Blanding's Turtle repatriation project has been underway at the Assabet River National Wildlife Refuge in eastern Massachusetts since 2007. The initial environmental assessment evaluated the relative benefits and risks of using various life stages of Blanding's Turtles collected from a donor population within the same watershed, including direct-release hatchlings (released shortly after hatching), head-started hatchlings (raised in captivity for nine months), sub-adults, and adults. The results of a simple population model suggested that a program of annual releases consisting largely of head-started hatchlings was the release strategy most likely to result in a stable population at the recipient site while minimizing negative impacts to the donor site. Direct-released and head-started hatchlings have been released at the Assabet River Refuge every year since 2007. Intensive aquatic trapping was done at the recipient site in 2013 as part of a mark-recapture effort to collect data for use in post-release survivorship estimates of head-started and direct-released Blanding's Turtle hatchlings. Collection of morphometric measurements from captured individuals is being used for comparison of growth rates between head-started and direct-released hatchlings.

Tue-PM1-B-2

Pre-adapted to Invade? Resource-use Strategies of Reciprocal Woody Invaders in the Northeastern US and France

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Abstract - Non-native, invasive plants in the deciduous forests of Eastern North America (ENA) generally exhibit greater productivity and resource-use efficiencies than native species. However, it remains unknown if species' traits measured in the invaded range are similar in the native range. Do these species possess traits pre-adapted for successful invasion? We compared leaf functional traits in populations of *Rhamnus cathartica* (Common Buckthorn; invasive in ENA, native in France) and *Prunus serotina* (Black Cherry; invasive in Europe, native in ENA) in both native and invasive ranges (N France and central NY). For *R. cathartica*, we found greater photosynthetic rates and leaf nitrogen concentrations in invasive NY populations. However, native populations exhibited greater photosynthetic nitrogen-use efficiency. This less-conservative strategy in invasive populations could be explained by lower leaf nitrogen-resorption rates than native populations. For *P. serotina*, we found similar photosynthetic rates between native and invasive ranges. However, invasive populations in France had increased respiration rates (carbon costs associated with growth) and reduced nitrogen costs. As a result, invasive *P. serotina* populations had greater photosynthetic nitrogen-use efficiency than those in central NY. These results indicate that trait-based invasion mechanisms may differ between forests across the northern hemisphere, and that resource-use strategies of invaders may be different than that in their native ranges.

Wed-PM1-C-1

Bat Biology in Central New York in the Age of White-nose Syndrome

John W. Hermanson (Cornell University, Coll. of Vet. Med., Ithaca, NY; jwh6@cornell.edu)

Abstract - White nosed Syndrome (WNS) has decimated the populations of *Myotis lucifugus* (Little Brown Bat) since its discovery in New York in 2006. Our group has studied bat populations in central New York since 1987, inheriting some of the locations from Prof. William Wimsatt's programs and moving ahead to establish new study sites. We have brought these data together to document a progressive reduction in summer maternity roost population numbers and to start thinking about how bats move between roost sites and why they might move. Our summer census data demonstrate nearly 95% reduction of expected numbers of bats surveyed across 8 maternity roosts. We have not identified *Pseudogymnoascus destructans*, the causative fungal species underlying WNS during the summer, supporting evidence that this is a cold-loving fungus. Thus, mortality is largely happening at winter hibernacula. Several study sites have had few or no bats during the course of our 3-year study (2011–2013), whereas two sites have shown reduced but stable numbers of female bats. Two barns that were previously used exclusively by *M. lucifugus* females are now supporting maternity colonies of *Eptesicus fuscus* (Big Brown Bat), suggesting opportunistic behavior by this latter species. However, *E. fuscus* juveniles have exhibited relatively high mortality during the neonatal/juvenile periods in several roosts that we studied, leading us to hypothesize that the roost selection by the mothers was not optimal. The interplay of bat species, human interventions, and an invasive pathogen all provide great questions for biologists to pursue. This research is supported in part by a Hatch Fund grant (NYC-435482).

Tue-AM1-A-4

Impact of Light Availability and Water Stress on Settlement and Survival of the Hemlock Woolly Adelgid

Mauri Hickin (University of Rhode Island, Kingston, RI; mhickin@my.uri.edu) and Evan Preisser (University of Rhode Island, Kingston, RI; preisser@uri.edu)

Abstract - *Tsuga canadensis* (Eastern Hemlock) is a dominant shade-tolerant tree in northeastern United States that is threatened by the invasive *Adelges tsugae* (Hemlock Woolly Adelgid; HWA). Determining how abiotic factors that affect tree health may also impact HWA is important in understanding the insect's expansion. Resources such as light and water can affect plant health as well as herbivore selectivity and damage. Using a 2*2 factorial design, we examined how HWA settlement and survival were affected by differences in light and water availability. We held 80 two-year-old hemlock saplings in a greenhouse at the University of Rhode Island. All 80 trees were covered with shade cloth: 40 trees with low-light shade cloth (10% light availability), and 40 trees with high-light shade cloth (90% light availability). Half of the trees (= 20) in each light treatment received ample water, and the other 20 were water stressed. All 80 trees were grown under these conditions for six weeks: at that point, the trees were inoculated with HWA. On old-growth foliage, HWA settlement was 50% higher in the low-light treatment than in the high-light treatment, and 37% higher on water-stressed versus well-watered plants; the treatments did not affect settlement on new-growth foliage. Once settled, neither the light nor water treatments affected HWA survival on new- or old-growth foliage. The fact that light and water availability impacts HWA settlement, but not survival, may help explain why some trees become infested with HWA more rapidly than others, a fact that may help develop more effective management strategies for hemlock forests invaded by this pest.

Tue-AM1-B-1

A Flora of Franklin County, Massachusetts: A Work in Progress

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Abstract - Franklin County, with 1877 sq km, is the 4th largest county in Massachusetts but ranks 12th in population density. It includes six ecoregions from the Worcester Plateau in the east through the Connecticut River Valley to the Berkshire Highlands on the west. Although there have been unpublished catalogs covering parts of the county, there has never been a county flora. Our aim is to produce a catalog of plants for each of the 26 towns in the county, including information on phenology and local abundance. In the past four years, we have accrued some 2000 field hours, examined more than 16,000 herbarium specimens, and tallied approximately 7500 records from literature sources. The flora stands at 1941 species, 1479 (76%) of which we have been successful at finding in the field since 2010. Our field surveys have documented 58 state-listed and 65 state watch-list species. Four state historic taxa have been rediscovered, and 12 taxa not previously recorded for Massachusetts and 188 new county records have been found. Approximately 27% of the flora is introduced. Our town-scale data are well suited for study of spatial-distribution patterns and, in conjunction with historic data, are useful for documenting floristic change over time. Certain locales within the county have been given sufficient historic attention by botanists to make comparisons with the contemporary flora. For example, changes in orchid diversity, non-native species, ruderal species, and other groups are readily discernible. Spatial patterns in the contemporary flora are also emerging, with many species showing strong east-west distribution patterns, generally mirroring the ecoregions that intersect the county. The project is ongoing, and we encourage anyone with experience in Franklin County to contact us with suggestions for places to visit or information about pertinent unpublished literature and specimens.

Tue-PM1-C-2

To Mow or To Mow Less: How Lawn Mowing Frequency Affects Bee Biodiversity and Soil Carbon Storage

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Abstract - As urban areas continue to expand, it is becoming more important than ever to study the ways that private yard care interacts with urban wildlife and ecosystem processes, and how yards can support wildlife. Lawns represent the most prominent features of urban yards, and lawn mowing is an important aspect of urban yard care, as well as a strong part of American culture. However, frequent lawn mowing can negatively affect yard biodiversity by removing the flowers utilized by pollinators, and can alter soil-carbon cycling by changing soil temperature and moisture. We explored how lawn-mowing frequency influenced ground arthropods, pollinators, and soil respiration in 12 yards in Springfield, MA, over the course of the summer in 2013. We recorded 68 species of bees of which 63 are native to New England. We also tracked lawn plant diversity and recorded 74 plant species, with more than 65% of these plants native to New England. Finally, we measured soil moisture, temperature, and respiration in each yard. Across all yards, soil temperature was the primary driver of soil respiration, with mowing frequency having a smaller effect on the soil environment and soil CO₂ fluxes. Although this study will continue through 2014, preliminary results suggest that urban yards can provide wildlife habitat and harbor a rich diversity of plants. This research also provided many opportunities for outreach and engagement with the yard owners, many of who were not previously aware of the myriad ways in which their yards were being used by plants and wildlife and promoting ecosystem services such as soil-carbon sequestration.

Wed-PM2-A-1

Assessment of Aquatic Assemblages with respect to Marcellus Shale Natural Gas Drilling in north-central Pennsylvania

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Abstract - One of the environmental concerns with Marcellus shale drilling has been potential impacts on some of the highest quality watersheds in the region. Such impacts could derive from land-use changes, with concomitant changes in sedimentation, temperature, and hydrology, and from accidental contamination by hydrofracturing fluid and/or flowback water. In 2011, we initiated studies on effects on aquatic ecosystems, focusing on highly forested watersheds in north-central Pennsylvania. Streams in these watersheds support *Salvelinus fontinalis* (Brook Trout), *Cottus* spp. (sculpins), and other species indicative of high-quality streams. In 2011, we sampled 28 sites, split into three groups: watersheds with no well pads, with relatively low well-pad densities, and with relatively high well-pad densities. State land comprises most of the watersheds; as a result, the maximum well-pad density was lower than in other areas, most well pads were often sited on ridge tops and hence set back from streams, and forest cover was high even in watersheds with well pads. In 2012, we resampled nine of the 28 sites. Depletion sampling of fish, crayfish, and salamanders in 100-m stream reaches was supplemented by targeted salamander sampling. We tested for the presence of differences among the three groups in species richness and taxon abundance using ANOVA and ANCOVA (including habitat variables). In 2011, there was no difference in any fish, salamander, or crayfish metric among the three groups. In the combined 2011–2012 studies, there were no differences in any of these metrics among treatment groups, although there were some between-year differences unrelated to well-pad density. The study also included analyses of algae, benthic macroinvertebrates, and water chemistry (2011–2013). The 2011 data for these elements did not show conclusive evidence of effects of drilling, although there were a few weakly significant or marginally non-significant differences (dominance, pH-association, and calcium-association for diatoms) related to well-pad density. This study is ongoing with additional sampling planned for 2014. Continued operation of the existing wells and new wells and well pads could lead to effects not currently evident. We are also continuing studies (chemical fingerprinting) to detect surface-water contamination associated with drilling.

Tue-AM2-A-2

The Landscapes of the Northern Forest

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Abstract - The northern forest region of northeastern North America contains about 60 vegetation types. These do not occur randomly. Instead they are organized into approximately 20 repeating patterns that, for convenience, we call landscapes. The patterns are familiar to most naturalists but are surprisingly poorly documented and, to our knowledge, have never been described in a comprehensive way. As part of the Northern Forest Atlas Project, we are developing a database of landscapes and a visual language to display the relations in the database. The goal is to produce a tool that will allow you to navigate graphically across four scales: landscape, vegetation, species, and details. Starting at landscape scale, with, say, the sandy coast, you will be able to move to any of the roughly 15 vegetation types within it; then to any of the characteristic species within that vegetation type; and then to a single species; and finally to the critical characters for that species. Starting at species scale with, say, *Rhus copallinum* (Dwarf Sumac), you can migrate laterally to related species or species that share critical characters, or upward to the vegetation types that contain the species and the landscapes that contain them. The first working implementation of this, for the woody plants, is at least a year away. Here we present the concept, illustrate the graphic language we are developing, and argue that since ecology is demonstrably multiscaled, successful ecological description needs to be multiscaled as well.

Wed-PM1-D-4

Genetic Variation and Genetic Differentiation of Mudpuppy Populations in the Northeastern United States

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Abstract - Sequences from two mitochondrial markers (cytochrome *b* and D-loop) were examined from 61 *Necturus maculosus* (Mudpuppy) sampled from nine drainages in four separate areas of the northeastern United States. Nine different haplotypes were identified, and the analysis of molecular variance (AMOVA) revealed that most of the variation occurred among regions. The magnitude of sequence divergence between the Mudpuppy population in the Connecticut River and other populations sampled from the Northeast suggests that the Connecticut River population is not native and was introduced from some source outside of the sampling area. Examination of the distribution of the five haplotypes observed within the Lake Champlain drainage provides no evidence of female-mediated gene flow across the lake between Mudpuppy populations in New York and Vermont. Populations sampled from Vermont tributaries of Lake Champlain contain from 1 to 3 haplotypes, with no apparent relationship between genetic variability and population size. Three of the four populations sampled from Lake Champlain drainage with sample sizes greater than 1, had either a single haplotype present or a common and very rare haplotype present; however, the fixed or common haplotype was different among these three populations indicating considerable genetic structuring. However, a small sample ($n = 6$) of a fourth population revealed 3 haplotypes, including one that was unique to this population and two that were common in populations to the north and south.

Tue-PM1-B-3

Risks to Biodiversity from Hydraulic Fracturing for Natural Gas in the Marcellus and Utica Shales

Erik Kiviat (Hudsonia, Annandale, NY; kiviat@bard.edu)

Abstract - High-volume horizontal hydraulic fracturing (HVHFF) for mining natural gas from the Marcellus and Utica shales is widespread in the $\approx 280,000$ km² of the Appalachian Basin, principally in West Virginia, Pennsylvania, Ohio, and potentially New York. Physical and chemical impacts of HVHFF include pollution by toxic synthetic chemicals, salt, and radionuclides; landscape fragmentation by wellpads, pipelines, and roads; alteration of stream and wetland hydrology; and increased truck traffic. These physical-chemical impacts contribute to changes in biota by, respectively: toxicological stress to sensitive species, diminished populations of habitat-interior or area-sensitive organisms and entry of nonnative weeds into habitats, shorter wetland hydroperiods and lower minimum streamflows, and increased road mortality of animals. Despite concerns about human health, there has been little study of impacts on habitats and biota. Taxa and guilds potentially sensitive to HVHFF impacts include freshwater organisms (e.g., *Salvelinus fontinalis* [Brook Trout], freshwater mussels, *Cryptobranchus alleganiensis* [Hellbender]), fragmentation-sensitive biota (e.g., forest-interior breeding birds, forest orchids), and species with restricted geographic ranges (e.g., *Plethodon wehrlei* [Wehrle's Salamander], *Exoglossum laurae* [Tongue-tied Minnow], *Aconitum noveboracense* [Northern Monkshood]) that are substantially concentrated in the shale-gas region. Impacts are potentially serious due to the rapid industrialization of the landscape for HVHFF over a large region. Whereas some impacts might be reduced by scrupulous industry and regulatory practice, others, particularly habitat fragmentation, cannot be reduced or mitigated. HVHFF impacts are cumulative with the impacts of other large-scale anthropogenic changes including coal mining, agriculture, forestry, land development, and climate change, but the cumulative impacts are difficult to assess.

Tue-AM2-A-1

General Discussion on the Impacts of Shale-Gas Development on Biodiversity

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Abstract - This will be an open discussion among all present on the myriad issues surrounding the potential impacts of shale-gas development on all aspects of biodiversity.

Tue-PM1-A-4

Testing the Predation Paradox in Western Massachusetts

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Abstract - A growing body of evidence suggests that predator-prey interactions in urban areas are decoupled, in the sense that predation rates do not correspond with predator abundance. This apparent paradox, which in the case of birds describes an increase in potential nest-predator abundances along a rural-to-urban gradient with no concomitant decline in avian nest success, has been termed “the predation paradox”. The goals of this study are to test for the existence of and explore possible mechanisms for this paradox in urban forest fragments versus rural forest in western Massachusetts. We focus on two species of shrub-nesting birds: *Hylocichla mustelina* (Wood Thrush; a species of conservation concern in Massachusetts) and *Dumetella carolinensi* (Gray Catbird; a potential urban-adaptor). Using standard nest monitoring, video monitoring, predator surveys, and motion-sensor still cameras, we are comparing nest success, relative abundance of nest predators, and actual predation events between urban and rural sites. Based on preliminary analyses and previous work in this system, we found more nest predators in urban fragments, yet there do not seem to be consistent differences in nest survival between urban and rural sites. Five nest predators were identified on video, including *Felis catus* (Domestic Cat), *Accipiters* (raptors), and *Sciurids* (squirrels). Further work is planned for the upcoming breeding season in order to identify the mechanism(s) responsible for increased abundance of nest predators in urban systems, and to explore alternative hypotheses to explain why these increases may not correspond to increased nest predation.

Tue-PM1-D-4

Columbia County, NY, Landscapes from the Perspectives of Plants, Ants, and Farms

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Abstract - About 80 years ago, the late Rogers McVaugh roamed Columbia County, creating one of the best of New York State’s local floras. For the past 10 years, we have been building on McVaugh’s work. Our goal has been both to explore some of the ecological patterns that McVaugh suggested and to develop ways of sharing those findings in publically accessible ways. We’ll share some preliminary insights from our on-going county-wide surveys about the distribution of plants and ants, and briefly describe how we hope to share this information through a county-scale cultural and ecological field guide. Participatory research with County residents is helping us understand the diverse views people have of the landscape. Lastly, we’ll touch upon work we have begun on a related aspect of landscape context: the role of wild species and their habitats in supporting low-input local agriculture. We have been working with agroecologists to describe the ecological interchange between cultivated and uncultivated lands. Wild nature and human use (such as agriculture) coexist in the County; our hope is to help people understand and so value wild nature for its own worth, while exploring aspects of its possible synergies with human undertakings.

Wed-PM1-D-1

Seasonal Occupancy and Diel Activity Periods of *Canis latrans* (Coyote) in New York City Parks

Carolyn Koestner (Mianus River Gorge, Bedford, NY; omarocks@live.com), **Chris Nagy** (Mianus River Gorge, Bedford, NY; research@mianus.org), **Mark Weckel** (American Museum of Natural History, New York, NY; mweckel@amnh.org), and **Suzanne Clemente** (Pace University, Pleasantville, NY; sc23198p@pace.edu)

Abstract - From January 2012 to February 2013, we deployed camera traps in 16 parks and protected preserves in New York City (NYC) to investigate the distribution and activity patterns of *Canis latrans* (Coyote) in the NYC metropolitan area. We used these data to examine seasonal variations in park occupancy and diel variations in activity. Coyotes were detected 538 times over the 13.5-month survey period and were found in all Bronx County parks surveyed at least part of the year. Results suggest that Coyotes in NYC are primarily nocturnal and crepuscular, likely due to avoidance of human activity. These results corroborate earlier studies on urban Coyotes. Additionally, Coyotes were found in fewer parks in the summer than in the fall and winter; this pattern suggests a range reduction around denning sites during the pup-rearing season.

Tue-PM1-D-3

Citizen Science for Natural History Data Processing

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Abstract - Citizen science has a long relationship with natural history, as amateur naturalists have gathered data on the living world for centuries. The Internet and the ubiquity of handheld devices has allowed for rapid recording and coordination of citizen-gathered data, resulting in a proliferation of natural history citizen-science projects. However, the strength of modern citizen science lies not only in the gathering of data, but also in the processing and analyzing of data collected by both people and machines. The declining cost of technology has made it possible to establish large-scale networks of automated cameras to capture information about the natural world at fine time scales. These camera networks can take hundreds of thousands of pictures every year, shifting the most time-consuming part of the science process from data-gathering to data-processing. Each image needs to be converted to sets of numbers that can be statistically analyzed. Computer algorithms available today have limited abilities to process the images resulting from camera networks; the human eye is far superior in adjusting for natural changes in scenes and for noting anomalies. I will describe two citizen-science projects I am involved in that focus on the analysis of camera network images: Snapshot Serengeti, in which volunteers identify large African animals, and PhenoCam, in which volunteers identify seasonal changes in North American vegetation. The former project has been running since December 2012, and the latter is in the planning stages. I will describe the challenges posed by citizen-science projects that focus on data-processing, as well as highlight the advantages.

Tue-AM1-D-1

Bird Behavior as an Indicator of Marine Ecosystem Health in Hudson River Park, New York City

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Abstract - Hudson River Park is located on the west side of Manhattan Island, NY, along the banks of the Hudson River. It is a long, thin park and includes both a terrestrial mixed-use area and a marine sanctuary. The Hudson River Park Trust is responsible for managing the park and has as one of its goals maintaining and improving the environmental health of the estuarine system. Since no directed effort to sample the aquatic portion of the park is being made, we used bird behavior in the park as an indicator of the marine health of the system. The aquatic resources of the park are used primarily by gulls, cormorants, and a variety of anseriformes. These birds use the waters of Hudson River Park primarily to rest and forage. Observations of bird behavior were made over the course of three seasons (summer, fall, and winter), and the instances of each behavior were quantified and found to be non-random. Foraging was virtually unheard of for ducks and geese, as they use the park strictly as a rest area at high tide. While cormorants were periodically observed foraging in the park, they were never seen to actually catch a fish. Gulls do forage frequently in the park, but specifically forage over the terrestrial regions where they pick up food scraps from human sources. The conclusion we draw is that the marine portion of the park is in relatively poor health and does not support as high a level of diversity or abundance of fauna as other estuarine systems in the New York City.

Tue-PM1-D-1

Effects of Habitat and Vegetation on Abundance of Black-legged Ticks (*Ixodes scapularis*) as Lyme Disease Carriers in Essex County, Massachusetts

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Abstract - *Ixodes scapularis* (Blacklegged-tick) functions as the main vector for the Lyme disease-causing spirochete *Borrelia burgdorferi* sensu stricto. The bacterium is transmitted to humans through the tick's bite and subsequent blood meal. In the past two decades, Lyme disease cases have drastically increased in prevalence within Eastern Massachusetts. One explanation for the increased incidences in Lyme disease and tick abundance is attributed to fragmentation, in which continuous forest is transformed into small isolated patches. This study seeks to look at tick abundance among larva, nymph, and adult stages as it relates to habitat type, vegetation type, and landscape fragmentation measured using geographic information systems (GIS). Habitats include natural edge, pasture edge, residential edge, and interior forest, with each represented by four study sites. Questing ticks were collected using the tick-drag method once per month. Vegetation surveys for each site consisted of: % leaf litter; % vegetation cover; basal area, richness, and density of over story trees; % canopy cover; and density of shrubs and understory trees. We characterized study sites using GIS analysis at a radius of 500 m. Results showed that larvae correlated positively with % vegetation cover and deciduous basal area, but negatively to shrub density. Similarly, nymphs demonstrated a positive relationship with % veg cover, but a negative relationship with shrub density. At a landscape scale, nymphs showed a positive relationship with the amount of human edge. We found a strong interaction between habitat, month, and adult abundance ($P = 0.097$); November residential averaged more adults than other habitat and month combinations. Month alone was significant ($P = 0.024$); November averaged more adults than other months. Adults also showed a positive correlation to shrub density. We are continuing to survey ticks and have now begun using nested PCR to determine prevalence of *B. burgdorferi* sensu stricto within the *Ixodes scapularis* ticks collected.

Wed-PM1-B-4

Diel Vertical Migration of Crustacean Zooplankton in Two Lakes in Northern New York

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Abstract - Diel vertical migration (DVM) is an adaptive behavior influenced by physical and chemical changes in habitat and is commonly observed in many aquatic organisms. Typical migration in most crustacean zooplankton taxa is characterized by a descent into the lower strata during the day followed by ascension toward the surface waters at night. To analyze zooplankton migration patterns in relation to environmental parameters, we conducted vertical tows using 153- μ m- and 250- μ m-mesh closing nets at 5-m increments in addition to a battery-powered pump sampler at 2.5-m increments at two 50-m deep sites in Lake Champlain and Lake George, two large lakes in New York State. Sampling occurred in discrete day and night sessions monthly from June 2013 to September 2013. Results suggest differences in zooplankton vertical structure between the oligotrophic Lake George and the mesotrophic-oligotrophic pelagic zone of Lake Champlain, with crustacean species residing deeper in the water column in Lake George during the day and displaying larger migration amplitudes than those observed in Lake Champlain. Cyclopoid copepods displayed particularly large migration amplitudes in both lakes when compared to cladocerans and rotifers. Seasonal comparisons between the two lakes suggest that light transparency may be the dominant factor driving DVM patterns of crustacean zooplankton in both lakes, with thermocline and phytoplankton depth being secondary factors. In Lake George, the invasive predatory cladoceran *Bythotrephes longimanus* (Spiny Water Flea) may discourage nocturnal migration to the epilimnion for some species that display typical migration behavior in Lake Champlain, a system in which *B. longimanus* is absent.

Tue-PM1-B-1

Effects of Hemlock Logging on Overstory, Sapling, and Understory Vegetation in Hemlock-Dominated Forests

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Abstract - *Tsuga canadensis* (Eastern Hemlock) is a foundation species that creates unique aesthetics and microclimates. *Adelges tsugae* (Hemlock Woolly Adelgid; HWA) is infesting and killing hemlocks throughout their range but has only recently been found in coastal Maine. Forest managers require knowledge of how plant community composition will shift in response to both HWA presence and salvage logging for *T. canadensis* that is occurring prior to HWA arrival. Here we present changes in the canopy, sapling, and understory vegetation layers 3 years after salvage logging for *T. canadensis*. We conducted vegetation surveys and measured light levels in 25 logged and 25 unlogged 100-m² plots from three uninfested hemlock stands. Logged stands were harvested 1-2 years prior to beginning data collection and had significantly lower overstory basal area ($P < 0.0001$) and stem density ($P < 0.001$). Sapling density was higher in the unlogged plots than the logged plots, but sapling species richness was higher in the logged plots. *Abies balsamea* (Balsam Fir) was the dominant sapling of the unlogged plots (43% of basal area), whereas the logged plots were co-dominated by *Fagus grandifolia* (American Beech, 22%) and *T. canadensis* (20%). Understory vegetation was divided into 5 functional groups (Forbs, Graminoids, Monilophytes and Lycophytes, Shrubs, and Woody Seedlings). The abundance of the functional groups differed significantly ($P = 0.001$), with the logged plots supporting higher densities of Grasses, Shrubs, and Woody seedlings. The most abundant woody seedling was *A. balsamea* in the logged plots and *Pinus strobus* (White Pine) in the unlogged plots. Although no difference in Forb abundance between logged and unlogged plots was detected, there were significantly higher densities of *Solidago* (Goldenrod) species and *Veronica officinalis* (Common Speedwell) in the logged plots. The logged plots also had significantly higher light levels ($P > 0.001$). The open canopy of the logged stands appears to be supporting an understory increasingly dominated by ruderal species. Logging also appears to have a negative impact on sapling advance regeneration. Our findings suggest the possibility of significant long-term changes in mixed northern hemlock-hardwood forests as they and their managers respond to the threat of HWA.

Tue-AM1-B-5

A Multi-Scale Analysis of Rusty Blackbird Nest Survival in Northeastern Industrial Forests

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Abstract - *Euphagus carolinus* (Rusty Blackbird) numbers have plummeted since the mid-20th century with no clear cause, but recent research in New England suggested that an ecological trap, created through timber harvesting on the breeding grounds, may be implicated. Nest predators were hypothesized to be *Tamiasciurus hudsonicus* (Red Squirrels), but definitive identification was lacking. The potential for masting cone crops to affect Rusty Blackbird nest predation via trophic interactions also remained unexamined. Our objectives were to identify the mechanisms by which an ecological trap may be operating in New England through a multi-scale analysis of Rusty Blackbird nest survival and predator identification and quantification. We monitored 72 Rusty Blackbird nests in Maine and New Hampshire in 2011 and 2012, and related nest survival to habitat characteristics at the nest-patch (5-m) and home-range (500-m) scale. We placed camera traps at 29 nests to identify nest predators, and conducted surveys to obtain an index of squirrel abundance each year. At the nest-patch scale, we found that nest survival increased with increased vegetative cover but was not adversely affected by harvest history of the nest site. At the home-range scale, we found that nests that were closer to the road were less successful in 2011, but not in 2012. Red Squirrels were the most frequent predator of Rusty Blackbird nests, but only in 2012, when they were generally abundant. Abundance of spruce and fir cones was high in 2011 and low in 2012. These results suggest fluctuating predator populations mediated through cone mast, rather than timber-harvesting activity, may be driving Rusty Blackbird nest survival.

Wed-AM1-D-1

Shifts in Small-Mammal Abundance and Lyme Disease Infection Rate at Varying Scales Among Four Different New England Habitat Types

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Abstract - In New England, small mammals are one of the primary reservoirs of *Borrelia burgdorferi* sensu stricto, the bacteria most commonly associated with Lyme disease. Intense development throughout the region has fragmented the landscape, resulting in novel habitat types and shifts in small-mammal communities. We sought to determine how small-mammal abundance, richness, and infection rate varied amongst habitats relative to several landscape and vegetative variables. We surveyed small-mammal communities at 16 different study sites over two years, sampling equally from four distinct habitat types: interior forest, human edge, residential edge, and natural edge. Only *Peromyscus leucopus* (White-footed Mouse), *Peromyscus maniculatus* (Deer Mouse), and *Blarina brevicauda* (Short-tailed Shrew) were sampled at abundances large enough for analytical consideration. Using a GIS of the study region, we delineated forested area, linear human edge, linear natural edge, and patch size within a 500-m radius of each site. We also conducted vegetation surveys at all sites. DNA from the tissue samples of collected specimens was isolated and analyzed using nested PCR for the presence of *Borrelia burgdorferi* sensu stricto. Results showed that *Blarina brevicauda* were significantly more abundant at residential-edge sites than at interior sites ($P = 0.0057$) or natural-edge sites ($P = 0.048$). We also found that total small-mammal abundance was significantly greater at human-edge habitats than at natural-edge habitats ($P = 0.0358$). Stepwise linear regression models of our dependent variables generally showed associations between individual species abundance and landscape variables, while total small-mammal abundance was dependent only upon small-scale vegetative variables. Our preliminary PCR results show that infection of small mammals was least frequent at human-edge habitats (5%), followed by natural-edge, residential-edge and interior-forest habitats (17%, 21%, and 47%, respectively). These results indicate that increasing small-mammal abundance does not necessarily indicate more frequent rates of infection.

Wed-PM2-C-2

Stable Isotopes Suggest Some Wolves in Canada South of the St. Lawrence River are of Wild Origin

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Abstract - Genetic analysis confirms a free-ranging canid killed near Caraquet, NB, Canada, in 2012 is a *Canis lupus* x *C. lycaon* hybrid (Grey Wolf x Eastern Wolf). The Caraquet wolf is the first wolf recorded in New Brunswick since 1862. Stable isotope $\delta^{13}\text{C}$ values suggest the animal is of wild origin. Likewise, $\delta^{13}\text{C}$ analyses suggest a wolf killed in Quebec south of the St. Lawrence in 2002 is also of wild origin. However, $\delta^{13}\text{C}$ values for a 2006 wolf from the same region are ambiguous. Recent occurrences of wild-origin animals south of the St. Lawrence demonstrate that wolves are capable of dispersal to areas formerly occupied in southeastern Canada and the United States. However, natural dispersal alone will likely not be sufficient to re-establish the wolf in the northeast. Adequate samples from dispersing wolf-like canids that suffer mortality are not currently being routinely collected and archived. Such samples could be helpful in guiding management decisions concerning wolves in the region.

Wed-PM2-C-4

Morphological and Phenological Differences in Adult *Dolophilodes distinctus* (Trichoptera) at Urban and Rural Headwater Streams

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Abstract - Urban land use alters the physical and chemical properties of streams draining watersheds, which typically decreases the quality of habitat for larval insects living in the stream. Physiochemical properties of the stream, as well as urban landscape features, can also affect emergence, behavior, dispersal, reproduction, and body morphology of the adult stage. We compared peak abundance time, synchrony of male and females, and body morphology of *Dolophilodes distinctus* (Trichoptera: Philopotamidae) at four urban and four rural headwater streams over 32 weeks. Peak abundance occurred earlier at urban streams than rural streams, and reproductive asynchrony occurred for rural populations but not for urban populations. These results suggested that urbanization may impact mating or emergence processes by *D. distinctus*. Forewing length (a proxy for overall size) was larger for individuals caught at urban as compared to rural streams. A larger body size favors dispersal, and so size differences may have resulted from the higher proportion of immigrants at two urban sites and a high abundance of residents at one rural site, with other sites exhibiting a mix of residents and immigrants.

Tue-PM2-B-2

Ants in the City: Can Community Gardens and Citizen Scientists Help Preserve Insect Biodiversity?

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Abstract - The global trend of urbanization presents a major threat to biodiversity. Currently, over 80% of the population of the United States lives in urban environments. Urbanization replaces natural habitat with a matrix of buildings, streets, and parking lots, at best preserving only fragments of the native ecosystem in parks and urban green spaces. The maintenance of healthy insect communities is vital to the preservation of biodiversity as a whole in such habitat fragments, yet we still know very little about how insects utilize urban green spaces. As part of an ongoing collaboration between Lesley University and community partners, we sampled ant communities in urban forest reserves and community gardens in the Boston area along with teams of high school educators and students. We correlated overall biodiversity and the abundance of native/invasive species with community-garden characteristics, including distance to and connectivity with larger reserves. We also evaluated the quality of species data collected by citizen scientists. Results and impacts of this study are discussed in light of future planned efforts to engage educators and students in the preservation of insect biodiversity and urban green spaces.

Tue-AM1-D-4

Identifying and Managing Impacts of Natural Gas Pipelines on Timber Rattlesnakes in the Northeast

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Abstract - Upgrading aging utility infrastructure has the potential to impact wildlife species significantly. New construction technology requires larger right-of-ways for utility construction, infringing on the critical habitat created by existing ROWs that are used by many species of birds and reptiles. In the case of natural gas pipelines, the actual pipeline corridors have in some instances been colonized by various snake species, including *Crotalus horridus* (Timber Rattlesnake). Many new pipelines that are being constructed to accommodate shale gas production are built as parallel lines adjacent to existing pipelines. Older lines are being dug out and replaced by larger pipe. In both cases, the Timber Rattlesnake, as well as other species that have colonized existing corridors and utilize the adjacent rock windrow for basking and gestating, could be put at risk. The objective of the ongoing study in New York, Pennsylvania, and New Jersey is to identify the criteria which initiated snake colonization of the pipeline corridors, improve methods of locating these sites, and determine how best to protect them during maintenance and construction. Criteria associated with pipeline corridor denning included the lack of water-break installation during the original construction, groundwater seepage through the area, and sometimes the presence of *Marmota monax* (Woodchuck). Surveys revealed that pipeline-corridor denning occurs in abandoned pipelines dating back as far as 1900 as well as in active lines. At one study site, replacement of an existing line in 2008 avoided Timber Rattlesnake den sites by creating bypasses and abandoning sections in situ. Surveys and telemetry in 2013 revealed snakes hibernating in the abandoned pipeline corridor. During maintenance work on a 1950s pipeline, the authors observed approximately 75 excavations in rattlesnake habitat. Of those, only a previously known denning site had voids and cavities in the corridor suitable for rattlesnake hibernation. The integrity of this site was preserved by careful excavation and backfilling. Basking and gestating habitat created or restored under the guidance of the authors on several pipelines has proven successful as evidenced by the presence of Timber Rattlesnakes utilizing them.

Tue-PM1-A-3

The Role of Antimicrobial Peptides in Resisting and Treating Bat White-nose Syndrome

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Abstract - Since 2006, the emerging fungal disease known as white-nose syndrome (WNS) has spread >2000 km from the original site of observation near Albany, NY and has killed >5 million hibernating bats. However, mortality rates among surveyed species range from 12 to 98% and at least one species, *Corynorhinus townsendii virginianus* (Virginia Big-eared Bat), appears to be thriving despite exposure. Within species exhibiting extremely high rates of mortality, there is also evidence of multi-year survivors in areas heavily affected by WNS. This presentation will first summarize our current understanding of WNS impacts across species and describe species-specific responses to the causative agent, *Pseudogymnoascus destructans*. I will then discuss the potential role of between- and within-species variation in endogenous skin proteins. In contrast to other aspects of immune defense, these antimicrobial peptides (AMPs) are constitutively expressed in the skin where the fungus invades, may have immediate anti-fungal properties, and are likely to remain functional during hibernation. A first genomic survey of chiropteran AMPs has revealed patterns consistent with strong positive selection in bats. This finding is consistent with multiple challenges requiring effective innate immune function during a long lifespan. Analyses of within-population variation currently in progress will help uncover how some individuals and species are able to resist infection by *P. destructans*. The discovery of antifungal AMPs may also lead to the development of an effective preparation that can be safely used on the host or applied to the environment to slow the spread of WNS.

Tue-AM1-A-1

Talus Slopes as Opportunities to Study and Monitor Populations of Eastern Small-footed Bats

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Abstract - Much of the natural history of *Myotis leibii* (Eastern Small-footed Bat) is undocumented, and this has negatively influenced understanding of its conservation status. Typical methods used to monitor bats, including surveys of hibernacula and those using mist nets in summer, appear poorly suited for Small-footed Bats. We used novel techniques to document and monitor the species on talus slopes in the Blue Ridge Mountains of Virginia, including: placing mist nets directly on talus slopes, conducting timed visual searches for roosting bats, quantifying local populations by surveying randomly distributed plots, and inferring timing of migration with visual searches and telemetry data-loggers. Mist nets placed directly on rocks and timed visual searches resulted in 5.0 ± 1.0 bats (mean \pm SE) per sampling visit and 1.2 ± 0.3 bats per person-hour, respectively, making either technique preferable over traditional surveying techniques. Surveys of plots suggested talus slopes had 59 ± 51 bats per ha of talus habitat, and the largest population studied was estimated to be ≈ 177 bats. Repeated visual searches and telemetry data indicated bats rarely left talus slopes until mid-September, when they began spending less time on-sight (perhaps coinciding with the swarming period). Bats may have migrated off-site or entered hibernation by early November. Limited surveys of unconsolidated caves within the talus slope have so far not revealed whether bats hibernate on-site. Combined results suggest uncovering the biology of Small-footed Bats is quite feasible if research is focused in appropriate habitats. Monitoring populations on talus slopes may be one way to assess the status of Small-footed Bats.

Tue-AM1-A-3

Green Space Within Home Ranges of Red-tailed Hawks in an Urban Environment

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Abstract - In recent years, there has been an increase in urban *Buteo jamaicensis* (Red-Tailed Hawk) populations; however, little is known about spatial relationships or habitat associations of these urban hawks. We investigated associations between individual hawk home ranges and the total amount and patch-size distribution of green space within the home ranges. Data were obtained using VHF telemetry on eleven hawks in Hartford, CT, during 2006–2011. “Green space” was identified using a map layer obtained from the CT Department of Energy and Environmental Protection and by digitizing aerial photographs. We found a weak negative association between home-range size and proportion of green space but no association between home-range size and average patch size of green space. Approximately 87% of the green-space patches within hawk home ranges were less than 2 ha, raising questions about what constitutes “usable green space” to an urban hawk. Maintaining green space in urban areas, particularly large patches, should help ensure continued success of urban Red-tailed Hawk populations.

Tue-PM1-D-2

Small Mammal Population Dynamics on Bumpkin Island in the Boston Harbor

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Abstract - We trapped small mammals on Bumpkin Island in the Boston Harbor 21 July–1 August 2008, 6–31 July 2009, and 20 June–1 July 2011 in an attempt to record patterns of species distribution and population dynamics. The only species captured during these intervals were native *Peromyscus leucopus* (White-footed Mouse) and *Microtus pennsylvanicus* (Meadow Vole). During the 2008 season, there were 231 capture events, and over 120 individual animals were trapped in 800 trap nights. In 2009, there were 282 capture events, and over 108 individual animals were trapped in 600 trap nights. In 2011, there were only 54 capture events, and over 16 individuals trapped in 549 trap nights. Both mice and voles were trapped in 2008 and 2009, though only mice were trapped in 2011. The proportion of voles captured in 2009 was significantly higher than in 2008. The variation in the proportions of each species between years may be attributed to a number of factors including 1) variations in weather patterns that may have impacted the food supply of these rodent populations, 2) the presence of predators on the island in 2008 (*Canis latrans* [Coyotes]) and 2011 (*Noevison vison* [American Mink]) but not in 2009, and 3) population cycling of voles. This finding is noteworthy since small mammals on islands typically do not exhibit the same population-cycling patterns as mainland populations. However, the sporadic presence of predators, a unique characteristic of some of the harbor islands, may result in population fluctuations.

Wed-PM2-C-5

Imperiled Old-growth Hemlock Stands of Southern New England

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Abstract - *Tsuga canadensis* (Eastern Hemlock) plays a unique role in Eastern forests, producing distinctive biogeochemical, habitat, and microclimatic conditions that are even more distinctive as trees age and become more dominant. To examine how ancient hemlock forests developed and changed over time, we examined the age, structure, composition, downed coarse woody debris (CWD), snags, and tree-ring growth patterns within 16 old-growth hemlock forests in western Massachusetts. Maximum hemlock age within these un-even aged stands averaged 344 years across all sites, and 3 stands had trees greater than 420 years old, including a tree that was 494 years old. Structurally, diameter distributions varied among old hemlock stands and included bell-shaped, skewed unimodal, rotated sigmoid, and reverse-J distributions. Despite their longevity, stands were very dynamic, experiencing frequent, low-intensity disturbances that affected an average of 5% of the canopy area per decade. Tree-establishment dates and tree-ring patterns examined at each site provided evidence that several past hurricanes and ice storms resulted in several synchronous disturbance peaks and subsequent recruitment opportunities in sites separated by more than 50 km. However, the lack of synchrony in proximate areas during these events highlights the patchy nature of disturbance on the landscape. There was no evidence of stand-replacing disturbances from 1700–1989, and the maximum canopy area disturbed in any decade was 26%. Sites with high past disturbance tended to have the highest volumes of downed CWD. All old-growth hemlock stands are now threatened by the invasive *Adelges tsugae* (Hemlock Woolly Adelgid; HWA) that causes foliar damage, crown loss, and mortality of host trees. Continued persistence and migration of HWA in this region may irrevocably alter the communities of these iconic species.

Tue-PM2-C-2

New Analyses of the Middle-Holocene Hemlock Decline in Southern New England

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Abstract - The abrupt, range-wide decline of *Tsuga canadensis* (Eastern Hemlock) \approx 5500 years ago is one of the most-studied events in North American paleoecology. However, despite decades of study, key aspects of the *Tsuga* decline remain poorly understood. Recent analyses of sediment cores from sites in north-central and western Massachusetts provide new insights into the cause, rate, and geographic pattern of this event. The *Tsuga* decline has been attributed to an insect outbreak, but analyses of Hemlock Hollow, a vernal pool in north-central Massachusetts that has been surrounded by *Tsuga canadensis* for the past \approx 10,000 years, did not yield insect remains in sediments dating to the *Tsuga* decline. On the other hand, reconstructions of lake-level history at sites across southern New England reveal dry events at 5500, 5000, and 4200 years ago, suggesting that the *Tsuga* decline was initiated and sustained by major droughts. Detailed radiocarbon dating of the middle-Holocene interval of lake-sediment cores from the Berkshires of western Massachusetts indicate that *Tsuga canadensis* declined rapidly, with sizable population reductions occurring in less than a century. Moreover, it appears that the *Tsuga* decline in the Berkshires took place later in upland areas than at lowland sites, perhaps because cool and moist conditions at higher elevations allowed *Tsuga canadensis* to survive for a period of time despite severe drought across the region.

Tue-PM2-C-3

Local and Landscape Predictors of Bee Richness and Abundance in Backyard Gardens of Northwest Ohio

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Abstract - Habitat degradation and fragmentation associated with urbanization can negatively impact species richness and composition of pollinators. However, green spaces within urban areas, such as gardens and forest fragments, may support bee diversity by providing floral resources and nesting sites in otherwise resource-poor environments. However, it is unclear whether urban backyard gardens with native plants will support more bees than gardens without native plants. We examined backyard gardens in Northwest Ohio to ask the following questions: 1) Does bee diversity, abundance, and community composition differ in backyard gardens with and without native plants? 2) What characteristics of backyard gardens and land cover in the surrounding landscape correlate with changes in the bee community? and 3) Do bees in backyard gardens respond more strongly to local or landscape factors? We sampled bees using pan trapping, netting, and direct observation. Further, we examined vegetation characteristics and land cover in 500-m, 1-km, and 2-km buffers surrounding each garden. Abundance of all bees, native bees, and cavity-nesting bees was greater in native plant gardens, and species richness of cavity-nesting bees was higher in gardens with native plants. Bee community composition differed in gardens with and without native plants, and composition was more similar across gardens with natives than those without. Overall, bee richness and abundance were positively correlated with local characteristics of backyard gardens, such as increased floral abundance, taller vegetation, more cover by woody plants, less cover by grass, and larger vegetable gardens. Differences in the amount of forest, open space, and wetlands surrounding gardens influenced abundance of cavity- and ground-nesting bees, but at different spatial scales. Thus, presence of native plants, and local and landscape characteristics might play important roles in maintaining bee diversity within urban areas.

Wed-PM2-A-3

Linking Landscapes for Massachusetts Wildlife: “A Model in Wildlife and Transportation Coordination”

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Abstract - Linking Landscapes for Massachusetts Wildlife (Linking Landscapes) is a partnership that was established in 2008 between the Massachusetts Division of Fisheries and Wildlife (MassWildlife) and Massachusetts Department of Transportation Highway Division (MassDOT). Its goal is to reduce wildlife-vehicle collisions and improve public safety; enhance, protect, and restore habitat impacted by roads; incorporate conservation priorities into transportation planning and design; and implement wildlife-transportation research. From identifying road mortality hotspots to building nesting boxes to restoring wetlands of high conservation value, community engagement and science-based prioritization is at the core of Linking Landscapes. The program grew out of a broader cooperative agreement to streamline the environmental review process. Linking Landscapes is a model partnership that has resulted in faster reviews, cost-savings, and the protection of endangered species and their habitat. Together, MassDOT and MassWildlife are working to implement MassDOT’s GreenDOT goal of enhancing the ecological performance of MassDOT impacted land.

Tue-AM-D-3

Timing of Peak Acorn Yield in Northern Red Oak at Flatrock Forest in Relation to Small Mammals

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Abstract - Oak trees can produce pulsed, synchronous mass-production of seeds; a phenomena coined “masting”. Among the diversity of trees in northeastern forests, mast events from *Quercus rubra* (Northern Red Oak) have been linked to wildlife demographics. In years of surplus, oak species may satiate granivores and thus enhanced germination rates occur in those years. Variation in annual seed yield within populations of Northern Red Oaks has been well studied. However, we sought to better understand the within-year timing of peak sound acorn maturation from a population of Northern Red Oaks near their northern range limit in upstate New York. Further, we compared the timing of sound acorn maturation with small-mammal trapping data. To measure this dynamic, we installed ten seed traps and then monitored them weekly from September 10th to October 9th 2013. We collected acorn yield (i.e., seed traps) and on-the-ground abundance data, and compared it with small-mammal presence. The peak seed rain of sound acorns, as well as the maximum small-mammal captures, occurred during the week of October 9th 2013. *Peromyscus* spp. (e.g., *P. maniculatus* [Deer Mouse] and *P. leucopus* [White-footed Mouse]) were the most-captured granivore species. When compared to seed-trap data, ground plots showed signs of acorn removal most likely attributed to small mammals or other acorn predators. The number of sound acorns recorded in the ground plot during the final week of the study was 75% less than the cumulative number of acorns found in the seed traps during the sampling season. Acorn masting is one of nature’s phenomena that demands further investigation. Our baseline data will eventually be used to help understand the mechanics of the phenomena and will hopefully lead to optimized management practices of the valued Northern Red Oak, a foundational species within the northern hardwood forest.

Wed-PM2-C-1

Population Dynamics of White Sucker in an Urban Stream

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Abstract - The *Catostomus commersonii* (White Sucker) population residing in the Saw Mill River, an urban stream, in Chappaqua, Westchester County, NY, was sampled during the summer of 2013. A total of 152 fish were weighed and measured, and from these data a length-frequency histogram was generated indicating that the population contained five age classes. Age classes were confirmed by scale analysis. Mean lengths and mean weights were determined for each age class in the sample, and from these data, the growth coefficients between age classes were determined using the relationship $W_t = W_0 * e^{gt}$. The results showed that the growth coefficient was 3.32 between ages 0+ and 1+, 1.38 between ages 1+ and 2+, 0.74 between ages 2+ and 3+, and 0.64 between ages 3+ and 4+, indicating rapid growth in the first stanza of life and a gradual decline in growth rate after that. Length-weight data was used to generate growth curves, and from these the parameters of the equation $W = aL^b$ were determined to be $W = 0.012L^{3.1523}$. A Student *t*-test determined that the slope of this equation was significantly different from 3.0, indicating that the population exhibited allometric growth. Using a Walford plot of length at time (t + 1) against the length at time (t), we determined that the L_∞ for the population was 32.73 cm. Age class, length, and weight data are consistent with previously published data for the White Sucker populations from other river systems.

Tue-PM2-B-1

Finding Efficiency in Amphibian Conservation: Rapid Assessments of Genetic Viability Predict Long-term Population Trends in the Wood Frog

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Abstract - Persistence of populations depends on both population size and genetic viability. However, few studies are able to integrate data on long-term population trends and genetic viability in order to predict population viability through time. We directly compared more than a decade of census population-size data with rapidly obtained genetic estimates of effective population size in ten populations of *Rana sylvatica* (Wood Frog). The Wood Frog life history and breeding phenology provide an ideal system to explore the predictive utility of genetic estimates of population size. Specifically, we tested how well estimates of effective population size obtained from 15 genetic loci and two estimation methods predict long-term demographic trends across ten populations. We found a strong association between genetic and census estimates of population size, suggesting that genetic estimates obtained in only a single sampling effort can provide an accurate picture of long-term population trends in this species. Greater fluctuations in annual census size led to a weaker association between census and genetic estimates of population size. We also predicted that several ecological attributes could influence population size; however, only water depth was associated with population size. While there is no replacement for long-term monitoring of populations, our data suggest that genetic estimates offer a rapid and robust assessment of both population size and genetic viability. Considering that conservation management often requires timely information on imperiled populations, efficiencies gained during the assessment phase can provide an important advantage for the conservation of amphibians and other taxa.

Wed-PM2-B-3

Iridoid Glycosides in Floral Nectar Alter Pollinator Behavior and Pollen Transfer Dynamics

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Abstract - Plants produce an array of chemical compounds known as secondary metabolites that may be deterrent or toxic to herbivores, yet are also present in plant parts such as floral nectar that are attractive to mutualists. Secondary metabolites in nectar could be an unavoidable consequence of plant chemical defense, or these compounds could have functional roles in plant reproduction. For example, they could deter consumers that do not pollinate, such as microbes or nectar robbers, or could attract pollinators, especially if consumption confers some benefit. Some secondary metabolites, including iridoid glycosides, reduce parasite infection of *Bombus* (bumble bee) pollinators, but it is unknown whether bees self-medicate, seeking out these compounds when they are parasitized. We measured concentrations of two iridoid glycosides, aucubin and catalpol, in nectar and other tissues of a bee-pollinated, obligately outcrossing plant, *Chelone glabra* (Plantaginaceae). We then manipulated nectar iridoids to create flowers with low and high iridoid glycoside concentrations relative to population means. We recorded visits to these flowers by parasitized and unparasitized bees and estimated pollen export to stigmas of other plants using powdered fluorescent dyes as pollen analogues. Iridoid glycoside concentrations were variable among sites and differed strongly between plant parts. Levels of aucubin and catalpol in nectar were not correlated with those of either compound in other tissues, suggesting that plants may control expression of these compounds in floral tissues separately from leaves. Bees foraged longer at flowers with high iridoid glycoside concentrations, exporting more dye to conspecifics than when they visited flowers with low iridoid glycoside concentrations. After visiting flowers in the high iridoid glycoside treatment, bees were more likely to fly to other plants in the population rather than visit second flowers, which could increase outcrossing success of plants. Bees with intestinal parasites (*Crithidia bombi*; Trypanosomatidae) and parasitoid fly larvae (*Physocephala* spp.; Conopidae) made significantly shorter flower visits than unparasitized bees, especially when both parasites were present. However, parasitism was not associated with preference for or deterrence from nectar iridoid glycosides, providing no evidence for self-medication behavior in the wild. Taken together, these results demonstrate that nectar secondary metabolites can manipulate pollinator behavior and subsequent pollen transfer.

Wed-AM1-B-4

An Overview of the Vermont Center for Ecostudies Bumble Bee Atlas

: **Leif L. Richardson** (Dartmouth College, Hanover, NH; leif.l.richardson.gr@dartmouth.edu), Kent McFarland (Vermont Center for Ecostudies, Norwich, VT; kmcfarland@vtecostudies.org), and Sara Zahendra (Vermont Center for Ecostudies, Norwich, VT; szahendra@vtecostudies.org)

Abstract - There is widespread concern over declines of managed and wild bees in North America, yet we lack the quantitative data necessary to investigate most claims of bee rarity. There is particular alarm about bumble bees (*Bombus*: Apidae), some of which have experienced abrupt population crashes in recent years. Most historical information about bee distribution and diversity comes from specimens held by academic and other museum collections. This information is a critical window to the past, but such specimens were seldom collected in a rigorous fashion, making comparisons to modern collections difficult. To address this data gap, the Vermont Center for Ecostudies conducted a two-year citizen-science-based inventory of bumble bees. We first created a database of >2500 historic bumble bee occurrences for the state, digitizing and georeferencing *Bombus* specimen data from 26 collections around North America. We drew on an existing network of naturalists with experience in inventory of other taxa (e.g., butterflies and birds), whom we trained to collect and identify bees according to a rigorous sampling protocol in representative “priority blocks” and at stations along road transects. Volunteers sent specimens to staff, who made species determinations and created a database of >10,000 collections. In accordance with recent work in other areas of North America, we report strong shifts in the diversity and relative abundance of Vermont’s bumble bees. One-third of species present historically were not found during the inventory. Formerly common species such as *B. affinis*, *B. ashtoni*, and *B. pensylvanicus* appear to be extirpated, and others, including *B. terricola* and *B. fervidus*, have greatly declined in relative abundance. Other species, especially *B. vagans*, have increased in relative abundance. In our analysis, we ask whether collections are correlated with spatial patterns of land cover, development, and agricultural activity, and we study whether bee host-plant use and phenology have shifted over time in response to human development or climate change. This inventory can be used as a model for other citizen-science inventories of invertebrate taxa, and we expect that the data will be a valuable baseline for future assessments of bumble bee abundance and distribution.

Wed-PM2-A-4

Predators of Hemlock Woolly Adelgid in the Pacific Northwest: Potential for Biological Control in the East

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Abstract - *Adelges tsugae* (Hemlock Woolly Adelgid), introduced to the eastern US from southern Japan, is causing widespread mortality of *Tsuga canadensis* (Eastern Hemlock) and *Tsuga caroliniana* (Carolina Hemlock). Current efforts to reduce hemlock mortality in eastern forests are focused on classical biological control. Once thought to be introduced in western North America as well, it is now known that Hemlock Woolly Adelgid is native to that region. A diverse suite of predators is associated with Hemlock Woolly Adelgid in the Pacific Northwest, but three adelgid-specific predators are the most abundant and frequent associates throughout Oregon and Washington. The three predators are a predacious beetle, *Laricobius nigrinus* (Derodontidae), and two predacious silver flies, *Leucopis argenticolis* and *Leucopis piniperda* (Chamaemyiidae). *Laricobius nigrinus* has been introduced and established in the East, but has not significantly reduced Hemlock Woolly Adelgid populations at release sites. Field studies in the Pacific Northwest have demonstrated that the *Leucopis* spp. are nearly as abundant and likely as important in the population dynamics of Hemlock Woolly Adelgid as *Laricobius nigrinus*. Laboratory feeding trials have shown that both *Leucopis* spp. can feed and develop on other adelgid species, but both prefer Hemlock Woolly Adelgid. Release of both *Leucopis* spp. in the East could potentially increase effectiveness of the biological control program.

Tue-AM1-B-2

A Tale of Two Toad Populations: Telemetry Studies of the Eastern Spadefoot at the Northern Extent of Their Range

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Abstract - *Scaphiopus holbrookii* (Eastern Spadefoot) is one of the rarest amphibians in the Northeast, and empirical data on the ecology of this elusive fossorial animal are sparse, which makes conservation planning for this species problematic. We studied two *S. holbrookii* populations, in eastern Connecticut and at the Cape Cod National Seashore in Massachusetts, to establish an understanding of their habitat needs in New England. We investigated upland movement patterns, post-breeding habitat use, and nocturnal, non-breeding burrow emergences using radio-telemetry and PIT tag technology coupled with logistic regression modelling and information theory. We detected *S. holbrookii* travelling from their points of release a mean maximum distance of 155 ± 29 m and 130 ± 28 m in eastern Connecticut and Cape Cod, respectively. In eastern Connecticut, *S. holbrookii* burrow locations had warmer soil, more percent cover of bare soil and gravel, and less percent cover of grass than paired random locations. In Cape Cod, individuals selected burrow areas closer to deciduous shrub edges and areas with greater percent cover of ground-running *Pinus rigida* (Pitch Pine) branches, deciduous shrubs, and *Cladonia* sp. (reindeer lichen), than paired random locations. *Scaphiopus holbrookii* emerged on 43% and 61% of nights monitored in eastern Connecticut and Cape Cod, respectively. In Cape Cod, rainfall was the only significant predictor of surface activity. In eastern Connecticut, *S. holbrookii* emergence nights were warmer and more humid than non-emergence nights. They were also much more likely to emerge on a given night if they had emerged the night before. Rainfall, however, was not a strong predictor of surface activity in Connecticut. Our results are applicable to conservation of this species in the Northeast. First, results from the post-breeding emigration distance and habitat use will enable regulatory agencies to more effectively define the upland area surrounding known breeding sites that should be under regulatory review. Second, results from the upland habitat use and nocturnal non-breeding burrow emergence analyses will enable further refinement of survey protocols aimed at documenting the presence of this species and will provide critical information to conservation and management practitioners working to restore and/or create upland habitat for *S. holbrookii*.

Wed-PM2-B-5

Many-legged Pilgrims: 400 Years of Invertebrate Introductions in Boston Harbor

Jessica J. Rykken (Museum of Comparative Zoology, Harvard University, Cambridge, MA; jrykken@oeb.harvard.edu)

Abstract - Boston Harbor has been an active port since the arrival of the first human colonists in the early 1600s and since that time has doubtless been a point of entry for many unseen invertebrate passengers arriving in the company of humans and cargo from around the world. The islands in Boston Harbor are also home to a suite of “weedy” exotic species that have traveled with or without the aid of humans from other points of introduction in North America. In 2005–2010, an invertebrate All Taxa Biodiversity Inventory in Boston Harbor Islands National Park area revealed that 239 of 1732 identified species (14%) were introduced from Europe or Asia. The earliest of these introductions are suspected to have occurred prior to 1650, and the most recent arrivals have likely been within the last several years as they represent first records for North America. Comparisons with nearby mainland species diversity among several beetle families showed proportions of introduced species on the islands to be two to three times higher than those on the mainland. For most of these beetle families, introduced species were, on average, more widespread across islands than native species and also more abundant. Many factors likely contribute to making the Boston Harbor islands a “hotspot” for non-native invertebrate biodiversity. Some of these will be discussed, as will several introduced species with interesting stories of immigration and establishment.

Wed-PM1-A-2

Incorporating Smartphone Apps and Citizen-Science Databases into the Monitoring Program at Intervale Lowlands Preserve

Ezra Schwartzberg (Adirondack Research, Saranac Lake, NY; ezra@adkres.org) and Michale Glennon (Wildlife Conservation Society, Saranac Lake, NY; mglennon@wcs.org)

Abstract - Intervale Lowlands Preserve in Lake Placid, NY is implementing a long-term, climate-informed monitoring program on its 54.6-ha (135-acre) property. Much of the data collection effort is organized through smartphone apps and observation-recording websites such as eBird, iNaturalist, and Nature’s Notebook. This web-interfaced and smartphone infrastructure contributes to our monitoring program in many ways by facilitating citizen-science involvement, expanding accessibility and use of our data, and streamlining data management. Used in coordination with more traditional survey tools, citizen-science-based smartphone technology has become a cornerstone of our long-term monitoring program. We will discuss pros, cons, and unexpected benefits of incorporating these apps and websites into biological-inventory and monitoring efforts.

Tue-AM1-D-2

The Alpine Landscape: Snowbed Research on Mt. Washington in Relation to Future Climate Change

Nancy G. Slack (The Sage Colleges, Troy, NY; nslack@nycap.rr.com)

Abstract - The alpine landscape has its greatest extent and biodiversity in the northeastern United States on Mt. Washington, NH, the highest mountain in the Northeast. A mosaic of many plant communities characterize this alpine landscape: from lichen-covered rocks—the felsenmeer—to wind-exposed shrub communities to sedge meadows and alpine ravines, tarns, small alpine lakes, and alpine bogs. They include diverse bryophytes, lichens, and vascular plants and their animal associates. The community that has been shown in European alpine studies to be most vulnerable to climate change, particularly rising temperatures, is the snowbed community. In these snowbeds, because of topography and slope, and sometimes shelter, snow remains later in the season than in any other community, protecting the plants. We studied snowbeds in the Alpine Garden and higher up on Mt. Washington’s cone, from 1620 to 1701 m (5316 to 5582 ft), using transect and quadrat methods for vascular plants, bryophytes, and lichens. This is an ongoing quantitative baseline study with-GPS-located sites for future monitoring. A suite of both alpine and boreal plants is found in these snowbed sites, including plants rare in New England and the world. The snowbeds are the most diverse plant community on Mt. Washington alpine summits; we have recorded over 50 vascular plant species and 40 mosses and liverworts thus far. We have also studied alpine streamside or rill communities and found these to have both similarities and differences in species composition compared to the the snowbeds and to also harbor rare vascular plants and bryophytes. The snowbed communities in Swedish mountains and in the Austrian alps are already losing species as the snow melts earlier; a similar fate may await our Northeastern alpine, including the Adirondack high peaks, with future climate change.

Tue-AM2-C-2

Lights, Camera, ... Citizen Science: Assessing the Effectiveness of Video-based Training in Invasive Plant Identification

Lena Fletcher (Environmental Conservation, UMass Amherst; lfletche@eco.umass.edu), **Jared Starr** (Environmental Conservation, UMass Amherst; jstarr@eco.umass.edu), Nathan Bush (Environmental Conservation, UMass Amherst; nathanbush0311@gmail.com), Charlie Schweik (ECO and PubPol, UMass Amherst; cschweik@pubpol.umass.edu), and Jack Finn (Environmental Conservation, UMass Amherst; finn@eco.umass.edu)

Abstract - The rapid growth and increasing popularity of smartphone technology is putting sophisticated data-collection tools in the hands of more and more citizens. The Outsmart Invasive Species Smartphone application (app) allows users to get text, image, and video information about invasive species instantly on their smartphone. Utilizing an “information commons” systems approach such as web-streaming videos to reach the critical masses, we produced invasive-plant-identification training videos to offset underprovided in-person training seminars. In our study of invasive-species monitoring through smartphone crowdsourcing, we compared three different app-user training methods to understand the effectiveness of each of the training types; (1) app-embedded species-identification text and images, (2) app-embedded species-identification training videos, and (3) formal in-person training. We focused on five invasive species common in western Massachusetts to compare user identification performance based on one of the three training methods. Results support our hypotheses that participants who do not receive in-person training, but have received video training, will perform better than text/image-trained participants. Results also indicate that video-trained participants may perform comparably to in-person trained participants. These results suggest that app-based species-identification training videos, followed by textual/image information, have the potential to fill the training gap needed to properly train citizens to identify invasive species.

Tue-AM1-D-3

Evaluating Pesticide Residues in Trapped Pollen from Honey Bee Hives in Connecticut

Kimberly A. Stoner (The Connecticut Agricultural Experiment Station, New Haven, CT; Kimberly.Stoner@ct.gov) and Brian Eitzer (The Connecticut Agricultural Experiment Station, New Haven, CT, Brian.Eitzer@ct.gov)

Abstract - Pollen trapped from *Apis mellifera* (Honey Bee) returning to their hives in five locations in Connecticut (including urban, rural, mixed and agricultural areas, and one orchard during pollination) had residues of 60 pesticides detected using liquid chromatography and mass spectrometry. To evaluate the relative toxicity of these pesticides to honey bees, we created a Pollen Hazard Quotient by dividing the concentration of the pesticide by the lethal dose killing 50% of adult workers (LD_{50}), and then related this to the dose of pesticide a nurse bee would experience at the maximum rate of pollen consumption. The pesticides with the greatest Pollen Hazard Quotients in our study were (in descending order) phosmet, imidacloprid, indoxacarb, chlorpyrifos, fipronil, thiamethoxam, azinphos-methyl, and fenthion.

Wed-AM1-B-2

Climate-Change Impacts on SuAsCo Watershed System

Ammara Talib (Dept. of Environmental Conservation, University of Massachusetts, Amherst, MA; atalib@eco.umass.edu) and Timothy O. Randhir (Dept. of Environmental Conservation, University of Massachusetts, Amherst, MA; randhir@eco.umass.edu)

Abstract - Watershed hydrologic processes are significantly influenced by changes in climate. These changes influence the rate of interception; evapotranspiration (ET), infiltration, and runoff have impact on soil loss and nutrient loads into water bodies. Therefore assessment of these influences on the watershed system in order to develop comprehensive conservation policies is needed. This study aims to model the impacts using climate change on water quantity and water quality. We conducted the research in the Sudbury, Assabet and Concord (SuAsCo) watershed of Massachusetts, which is predicted to experience these impacts resulting in runoff issues and water-quality impacts, especially increase in sediment and nutrients loading. We have used a watershed simulation model (HSPF) to simulate watershed processes. The model was calibrated and validating by using field data from MassDEP. A Nash-Sutcliffe equation is used to assess the efficiency of the model. We used a downscaled prediction of global climate models (GCMs) to assess climate change. Results indicate that changes in climate can significantly affect storm water flows and impact water quality both individually and in combination. There is a potential for reducing impacts of runoff, sediments, and nutrients loads by using watershed conservation strategies. Climate adaptation strategies could involve implementation of low-impact development practices and spatially targeted mitigation measures. These results provide valuable information to watershed managers and landowners for adaptation to climate change impacts.

Wed-AM1-D-4

Damage to the Structure and Function of Wintergreen Ferns Associated with Snowfall

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

Abstract - Anthropogenic climate change is resulting in winters with less snow than is historically typical. This deficit may have an impact on wintergreen ferns whose fronds lie prostrate under the snowpack and thereby are protected from frost. Frost damage and ecophysiological traits were quantified for three species of wintergreen fern (*Dryopteris intermedia*, *Dryopteris marginalis*, and *Polystichum acrostichoides*) near Delhi, NY before and after the winters of 2012 (which had very little snowfall) and 2013 (which had typical snowfall). *Dryopteris intermedia* was the most common species and had the highest percentage of frost-damaged fronds and the highest percentage of its cover damaged in 2012. Frost damage was significantly less in 2013 for all species. *Polystichum acrostichoides* had the highest vernal photosynthetic rate in undamaged fronds, and all three species had a negative net photosynthetic rate in frost-damaged fronds. The wintergreen fern community lost $36.69 \pm 2.80\%$ of its productive surface area to frost damage in 2012. *Dryopteris intermedia* had the thinnest leaves, and this trait may have made it the most susceptible to frost damage. These results demonstrate that repeated winters of little snow may have a significant impact on the structure and functioning of the wintergreen fern community, and species will respond to a reduced snowpack on an individual basis.

Tue-AM1-C-4

The Salamander Crossing Brigades: A Case Study in Applied Conservation from Southwestern New Hampshire

Brett Amy Thelen (Harris Center for Conservation Education, Hancock, NH; thelen@harriscenter.org)

Abstract - Amphibian road mortality is a growing conservation concern, particularly during the highly synchronized annual spring migrations (“Big Nights”) undertaken by vernal pool-breeding species in the Northeast. Observed road mortality rates along even low-traffic rural roads may be high enough to lead to localized extirpation of pool-breeding amphibians, and long-term impacts of roads on amphibian population dynamics can be severe. Design and installation of wildlife infrastructure (e.g., amphibian tunnels) is costly, and temporary road closures are often met with resistance by the general public. Over the last decade, conservation groups throughout the Northeast have responded to this issue by organizing “amphibian crossing brigades”, in which trained volunteers move spring-migrating amphibians across the road by hand during periods of peak traffic. This case study will present lessons learned from a longstanding volunteer amphibian-crossing brigade program in southwestern New Hampshire, and pose questions related to the potential development of a regional, multi-year, collaborative research initiative focused on amphibian road mortality in the Northeast. Potential collaborators—including, but not limited to amphibian crossing brigade coordinators and conservation biologists with an interest in road mortality—are especially encouraged to attend.

Wed-PM2-B-1

Four Scenarios for the Future of the Massachusetts Landscape

Jonathan R Thompson (Harvard Forest, Petersham MA; jthomps@fas.harvard.edu)

Abstract - Anticipating landscape- to regional-scale impacts of land use on ecosystems and the services they provide is a central challenge for scientists, policy makers, and resource managers. By analyzing multiple plausible land-use scenarios, scientists can bypass the inherent uncertainties associated with prediction within socio-ecological systems. Furthermore, by engaging with stakeholders to develop the scenarios, scientists can maximize the legitimacy, salience, and uptake of the results. The Massachusetts Future Scenarios Project integrated these elements into a participatory research initiative that developed, simulated, and analyzed four land-use scenarios: Recent Trends, Opportunistic Growth, Regional Reliance, and Forests as Infrastructure. Using consistent assumptions about major drivers, relationships, and constraints, the narrative scenarios describe futures that include different amounts, intensities, and spatial configurations of land development, timber harvesting, farmland expansion, and forest conservation for the entire state. All scenarios include the assumption that average temperature and precipitation will increase with climate change (consistent with the IPCC A1FI climate forecast). The scenarios were simulated using a modified version of the spatially interactive, process-based forest landscape model, LANDIS-II. Simulation outputs were then evaluated in terms of their impacts on direct human uses of the landscape (developed land, agricultural land, timber volume), ecosystem services (carbon storage, flood regulation, water purification), and biodiversity conservation (forest composition, interior habitat). The evaluation identified tradeoffs between dispersed residential development and most ecosystem services and habitat metrics. In addition, the scenarios showed synergies between increased harvest volume obtained through long-term silvicultural planning and restoration of forest composition and structure, with only minimal impacts on carbon storage. Overall, the results yield valuable insights related to the influence of landscape trajectories on future land cover, tradeoffs between benefits that accrue to individual landowners and those that serve a broader segment of society, trade-offs and synergies among different uses and bundles of ecosystem services, and the elements that are essential to increasing the impact of science on conservation and land-use policy. We found linking participatory research with decision-making through a process of continuous engagement, scenario experiments, and public outreach enhances both ecological understanding and the broader value of science to society.

Tue-PM2-C-4

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Abstract - *Scaphiopus holbrookii* (Eastern Spadefoot) is one of the rarest amphibians in the Northeast, and empirical data on the ecology of this elusive fossorial animal are sparse, which makes conservation planning for this species problematic. We studied two *S. holbrookii* populations, in eastern Connecticut and at the Cape Cod National Seashore in Massachusetts, to establish an understanding of their habitat needs in New England. We investigated upland movement patterns, post-breeding habitat use, and nocturnal, non-breeding burrow emergences using radio-telemetry and PIT tag technology coupled with logistic regression modelling and information theory. We detected *S. holbrookii* travelling from their points of release a mean maximum distance of 155 ± 29 m and 130 ± 28 m in eastern Connecticut and Cape Cod, respectively. In eastern Connecticut, *S. holbrookii* burrow locations had warmer soil, more percent cover of bare soil and gravel, and less percent cover of grass than paired random locations. In Cape Cod, individuals selected burrow areas closer to deciduous shrub edges and areas with greater percent cover of ground-running *Pinus rigida* (Pitch Pine) branches, deciduous shrubs, and *Cladonia* sp. (reindeer lichen), than paired random locations. *Scaphiopus holbrookii* emerged on 43% and 61% of nights monitored in eastern Connecticut and Cape Cod, respectively. In Cape Cod, rainfall was the only significant predictor of surface activity. In eastern Connecticut, *S. holbrookii* emergence nights were warmer and more humid than non-emergence nights. They were also much more likely to emerge on a given night if they had emerged the night before. Rainfall, however, was not a strong predictor of surface activity in Connecticut. Our results are applicable to conservation of this species in the Northeast. First, results from the post-breeding emigration distance and habitat use will enable regulatory agencies to more effectively define the upland area surrounding known breeding sites that should be under regulatory review. Second, results from the upland habitat use and nocturnal non-breeding burrow emergence analyses will enable further refinement of survey protocols aimed at documenting the presence of this species and will provide critical information to conservation and management practitioners working to restore and/or create upland habitat for *S. holbrookii*.

Wed-PM2-B-5

Terrestrial Invertebrate Communities in Isolated Salt Marsh Patches within Middle Bay, South Shore Estuary, Long Island, NY

Carolyn Trietsch (Adelphi University, Garden City, NY; carolyntrietsch@mail.adelphi.edu) and **Matthias W. Foellmer** (Adelphi University, Garden City, NY; foellmer@adelphi.edu)

Abstract - Salt marshes are home to a variety of insects, amphipods, crustaceans, spiders, and other invertebrates. These serve as food sources for other species, allowing estuarine salt marshes to function as nursery grounds for fish and migratory birds. Most of the original salt marshes in North America have been lost due to human activities, and the few wetlands that remain are threatened by factors such as pollution, land development, and climate change. Little is known to date about the invertebrate diversity of the remaining salt marsh patches in the Long Island South Shore Estuary and how, for example, diversity and food-web structure may be impacted by human activities. I extensively sampled the insect communities at three isolated marshes in 2011 and 2013 to establish a large base-line data set on the diversity and phenology of marsh insects. The goal of this research is to generate hypotheses of the impact of patch isolation and pollution from multiple sources on community structure and functioning. Sampling methods included terrestrial pitfall traps, sweep nets, beat sheets, vacuum sampling, and newly designed floating pitfall traps. All specimens were identified to the family level, including parasitic hymenoptera. I recorded over 100 different families and found marked differences in insect diversity between different marsh patches. This study represents the first widespread sampling of arthropod biodiversity performed in the South Shore Estuary. Along with presenting a more detailed view of terrestrial marshland insect communities, this work will provide a basis for future studies on the passage of heavy metal pollutants through invertebrate food webs and the use of predacious arthropods as indicator species to gauge the health of marshland ecosystems.

Tue-AM2-B-1

Long-Term Impacts of Imidacloprid Used to Control Hemlock Woolly Adelgid (*Adelges tsugae*) on Canopy Arthropod Communities

R. Talbot Trotter III (USDA Forest Service, Hamden, CT; rttrotter@fs.fed.us), Wingyi Kung (Penn State University, College of Agricultural Sciences, Entomology, University Park, PA; Wingyi_Kung@fws.gov), Kelli Hoover (Penn State University, College of Agricultural Sciences, Entomology, University Park, PA, kxh25@psu.edu), and Richard Cowles (Connecticut Agricultural Experiment Station, Windsor, CT; Richard.Cowles@ct.gov)

Abstract - The systemic neonicotinoid insecticide imidacloprid is commonly used in the management of *Adelges tsugae* (Hemlock Woolly Adelgid; HWA), an invasive pest that poses a severe threat to the native hemlock tree species, *Tsuga canadensis* (Eastern Hemlock). While the immediate (≤ 2 -year) impacts of imidacloprid on non-target organisms have been well-documented, the insecticide has been found in hemlock plant tissues eight years post-treatment, raising concerns for long-term impacts on non-target arthropods in hemlock ecosystems. Using trees treated nine years prior to survey, we found that imidacloprid was still detectable in some trees, though concentrations were very low. While imidacloprid was approaching the limits of detection, HWA densities remained lower on treated trees, and canopy arthropod communities differed between treated and untreated trees, suggesting the potential for long-term impacts following insecticide application.

Tue-AM1-B-4

Modeling Climatic and Hydrologic Uncertainty

Olga Tsvetkova (Dept. of Environmental Conservation, University of Massachusetts, Amherst, MA; ts_olya@ymail.com) and Timothy O. Randhir (Dept. of Environmental Conservation, University of Massachusetts, Amherst, MA; randhir@eco.umass.edu)

Abstract - Uncertainty in climate change plays a major role in watershed systems. The increase in variability and intensity in temperature and precipitation affects the hydrologic cycle in spatial and temporal dimensions. Predicting uncertainty in climate-change impacts on watershed systems can help to understand the risks facing us due to future climate-induced impacts on watershed systems and is essential for designing policies for mitigation and adaptation. We assessed modeling of the temporal patterns of uncertainties in the New England region for temperature and precipitation patterns over a long term. The regional uncertainty was modeled using spatial algorithms (Python) and GIS to analyze spatial patterns of climate change uncertainties over space and time. The results show that the regional uncertainty is significant in variation for changes in location and climatic scenarios. The results also show that uncertainty in climate change is spatially and temporally variable and impact watershed systems in New England. These findings indicate there is a need for watershed-specific strategies for adaptation to hydrologic intensification and variability at local and regional scales.

Wed-AM1-D-3

Bioaccumulation of Heavy Metals within the Invertebrate Food Web of Hempstead Bay, Long Island, NY

Andrew J. Vacca (Adelphi University, Garden City, NY; vaccaaj@gmail.com) and Matthias W. Foellmer, PhD (Adelphi University, Garden City, NY; foellmer@adelphi.edu)

Abstract - Investigating the effects of environmental and ecological degradation caused by the discharge of toxic pollutants is of paramount importance to assess overall ecological health, especially in heavily modified and impacted systems, such as the wetlands of the South Shore Estuary of Long Island, NY. Here we determined the current level of heavy metals both available within the environment, as well as accumulation in an invertebrate trophic system with *Lycosidae* (wolf spiders) as the top predators within the semi-terrestrial salt marsh environment. Sediments, *Spartina alterniflora* (Saltmarsh Cordgrass), *Prokelisia* sp. (planthoppers), and the wolf spider *Pardosa littoralis* were analyzed for the following heavy metal loads: Hg, Ni, Cu, Cr, Zn, Cd, Pb, and Ag. Samples were collected between June and Aug of 2011 along an assumed pollution gradient in Hempstead Middle Bay, originating from a major sewage effluent discharge into Reynolds Channel. We found statistically significant differences between trophic levels for zinc, copper, silver, cadmium, and mercury, supporting the hypothesis that heavy metal contaminants bioaccumulate within the invertebrate food web as defined by this study.

Tue-PM2-A-2

A Comparison of Pre- and Post-WNS Fungal Associations on Hibernating Bats in Eastern Canada

Karen J. Vanderwolf (Canadian Wildlife Federation/New Brunswick Museum, Saint John, NB, Canada; kjvanderw@gmail.com), Donald F. McAlpine (New Brunswick Museum, Saint John, NB, Canada; Donald.McAlpine@nbm-mnb.ca), and David Malloch (New Brunswick Museum, Saint John, NB, Canada; dmalloch@xplornet.com)

Abstract - White-nose Syndrome (WNS) is a disease caused by the fungus *Pseudogymnoascus destructans* (Pd). WNS has killed millions of bats in North America since first observed in 2006. Data documenting fungi naturally present on hibernating bats are still exceedingly rare, making it difficult to predict what, if any, impact the introduction of Pd might have on these assemblages. It has been suggested in a previous study that fungal diversity on hibernating bats may be suppressed by the presence of Pd. However we hypothesize that the natural fungal diversity on hibernating bats was not influenced by the introduction of Pd, in large part because fungi, other than Pd, are not known to actively grow on live bats. Based on a unique dataset collected immediately pre- and post-WNS infection in eastern Canada, we compared and contrasted fungal assemblages cultured from hibernating *Myotis* spp. We also sought to identify any fungi that may interact with Pd in culture. Preliminary data indicate that overall fungal diversity on hibernating bats did not change with the introduction of Pd. Several fungal isolates examined post-WNS appear to be antagonistic to Pd in vitro, although the nature of these interactions is still under study.

Tue-AM1-A-2

Columbia County, NY, Landscapes from the Perspectives of Plants, Ants, and Farms

Conrad Vispo (Hawthorne Valley Farmscape Ecology Program, Ghent, NY; conrad@hawthornevalleyfarm.org), **Claudia Knab-Vispo** (Hawthorne Valley Farmscape Ecology Program, Ghent, NY; claudia@hawthornevalleyfarm.org), **Kyle Bradford** (Hawthorne Valley Farmscape Ecology Program, Ghent, NY; kylebradford@gmail.com), Anna Duhon (Hawthorne Valley Farmscape Ecology Program, Ghent, NY; anna@hawthornevalleyfarm.org), and Gretchen Stevens (Hudsonia Ltd., Annandale, NY; stevens@bard.edu)

Abstract - About 80 years ago, the late Rogers McVaugh roamed Columbia County, creating one of the best of New York State's local floras. For the past 10 years, we have been building on McVaugh's work. Our goal has been both to explore some of the ecological patterns that McVaugh suggested and to develop ways of sharing those findings in publically accessible ways. We'll share some preliminary insights from our on-going county-wide surveys about the distribution of plants and ants, and briefly describe how we hope to share this information through a county-scale cultural and ecological field guide. Participatory research with County residents is helping us understand the diverse views people have of the landscape. Lastly, we'll touch upon work we have begun on a related aspect of landscape context: the role of wild species and their habitats in supporting low-input local agriculture. We have been working with agroecologists to describe the ecological interchange between cultivated and uncultivated lands. Wild nature and human use (such as agriculture) coexist in the County; our hope is to help people understand and so value wild nature for its own worth, while exploring aspects of its possible synergies with human undertakings.

Wed-PM1-D-1

Water Quality Assessment of Two Slow-moving Sandy-Bottom Sites on the Saw Mill River, New York

Barbara E. Warkentine (SUNY Maritime College, Bronx, NY; bwarkentine@sunymaritime.edu) and Joseph W. Rachlin (Lehman College of CUNY, Bronx, NY; joseph.rachlin@lehman.cuny.edu)

Abstract - Two sites on the Saw Mill River were selected for biological assessment of water quality using macro-invertebrate composition. Site one, located in Chappaqua, NY, is at the northern-most point on the river. Site two, located in Hawthorne, NY, is approximately six miles south of site one. Both are classified as having slow-moving water with sandy bottom substrates. The Chappaqua site has low shrubs on both shores with no overhanging vegetation, a parking lot abutting its east bank, and a railroad embankment running along the west bank. The Hawthorne site has good overhanging riparian forest vegetation on both shores. Its west bank abuts a commercial plant nursery. Given the close proximity of the Chappaqua site to a parking lot and railroad and the lack of overhanging vegetation, it was hypothesized that its water quality would be poorer than at the Hawthorne site. Macro-invertebrates were sampled using a ¼-m² Surber net with a 500-µ mesh. Samples were collected during June and July of 2009. Assessment metrics used were: Shannon-Weiner diversity, evenness, species richness, Hilsenhoff biotic index (HBI), Ephemeroptera Plecoptera Trichoptera richness (EPT), and non-Chironomidae and Oligochaete (NCO) richness. Coincident with each faunal sampling, measurements of air and water temperature, pH, conductivity, total dissolved solids, dissolved oxygen, water flow and velocity were recorded. Average values for all monitored physical conditions didn't deviate greatly from site to site. Shannon-Weiner diversity for Chappaqua was 2.32 with an evenness value of 0.20. Hawthorne's diversity was 2.68 with evenness of 0.31. Species Richness and NCO Richness were 49 and 22, respectively, for Chappaqua and 44 and 23, respectively, for Hawthorne. HBI was 7.99 for Chappaqua and 7.69 for Hawthorne. Both sites had equal EPT values of 5. Despite the differences in riparian vegetation and abutting properties, both sites were very similar in terms of physical conditions and water quality based on macro-invertebrate assessment indices. This result indicates that these sites can be classified as slightly impacted, thus refuting the original hypothesis.

Tue-PM2-B-3

Human Influences on Species Interactions in Urban Communities: New England in a Global Context

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Abstract - As the pattern of reduced diversity and increased abundance associated with urbanization has crystallized in recent years, competing explanations for the patterns have emerged. Some studies have emphasized the role of extinction and colonization processes. According to this view, the species present in a patch are the combination of the species colonizing the novel habitats formed with urbanization and those remaining after local extinctions are caused by isolation or habitat alteration from urbanization. An alternative, though not mutually exclusive view, is that species interactions, such as competition, play an important role in shaping community composition in urban habitats. For example, altered habitat structure and resource availability may favor colonizing species over native ones in competition for resources, leading to local extinctions of native species and elevated densities of a few strong competitors. We argue that using interdisciplinary approaches that incorporate the social sciences will yield greater insights into all these questions than solely disciplinary approaches. I present examples of altered species interactions and evidence of underlying human drivers from five cities: Baltimore, Boston, Fresno, Phoenix, and Raleigh-Durham and discuss recent findings on global patterns of urban biodiversity. Documented effects of urbanization on species interactions from these studies include: reduction in perceived predation risk by passerine birds, elevated apparent competition between synanthropic species and specialists in birds, and elevated floral antagonisms for a forest plant. While we have not yet documented these changes in interactions in all of the five cities, we do find some consistent effects of human activities and common human drivers. Basal resources such as food and water appear to be elevated in the city relative to surrounding wildlands, but specialized resources, such as nest sites for cavity-nesting birds, may be relatively depauperate. Socioeconomic gradients are associated with key resources in all five cities. Humans, therefore, are a major force in the spatial structuring of resources in metropolitan regions around the United States. The consequences of this spatial structuring may be profound, with implications ranging from foraging behavior to animal communication to natural selection on native plant traits.

Tue-PM2-D-1

Vulnerability of Northeastern US Salt Marshes to Climatic and Anthropogenic Stressors

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Abstract - In the Northeastern US, salt marsh area is in decline. Habitat-change analysis has revealed fragmentation, displacement of high-marsh by low-marsh species, and ecological drowning, while development of adjacent uplands limits upslope migration. Using inundation experiments, field surveys, and LiDAR datasets, we developed an elevation-productivity relationship for *Spartina alterniflora* specific to the US Northeast states of New York, Connecticut, Rhode Island, and southern Massachusetts, and located current salt marsh orthometric heights on this curve. We determined that 89% of salt marshes in these Northeastern states are located at elevations where growth is limited by inundation, suggesting links between current salt marsh loss patterns and sea-level rise. By manipulating water-column nutrients, precipitation, and elevation, we further found that altered precipitation receipt was associated with significant reductions in biomass, and that nutrient enrichment adversely impacts organic matter accumulation and peat formation. These results provide evidence that Northeastern US marshes are vulnerable to the effects of accelerated sea-level rise, and that neither precipitation changes nor cultural eutrophication will contribute positively to long-term salt marsh survival.

Tue-PM2-A-4

Annual Fluctuations in Prevalence of *Batrachochytrium dendrobatidis* during a Two-Year Field Study in Oswego County, NY

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Abstract - The chytrid fungus *Batrachochytrium dendrobatidis* (Bd) has been responsible for notable population declines and extinctions of amphibians globally. Similar declines have not been noted in the Northeast, despite the documented presence of the pathogen. A total of 226 amphibians and associated environmental data (temperature, humidity, etc.) were sampled from various habitats at several field sites in Oswego County April–November in 2012 and 2013 as part of a long-term study monitoring amphibian populations and emerging diseases. Swabs collected from the individuals were analyzed for the presence of Bd using a standardized end-point PCR protocol. The fungus was detected on *Lithobates clamitans* (Green Frog) both years and on *Lithobates catesbeianus* (Bull Frog), *Pseudacris crucifer* (Spring Peeper), and *Eurycea bislineata* (Two-lined Salamander) in 2012 only. Overall Bd prevalence was drastically different in the two sampled years: 30% of sampled amphibians in 2012 carried the pathogen in contrast to 3.4% in 2013. Fluctuating prevalence rates of the pathogen could indicate that climactic conditions specific to the Northeast may moderate pathogen presence on amphibian hosts.

Wed-PM2-B-4

Long-term Avian Response to Forest Fragmentation from Shale-Gas Development

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Abstract - The extensive tracts of mature hardwood forest in West Virginia support a high diversity and abundance of breeding songbirds, including several species of high conservation priority in the Appalachian region. To understand effects of shale-gas development on breeding songbirds, we conducted point-count surveys annually during 2008–2013 at 142 survey stations in a 6521-ha study area of primarily mature forest in northwestern West Virginia. On the same area during 2009–2013, we also quantified *Parkesia motacilla* (Louisiana Waterthrush) nesting survival, territory density, and habitat condition on 12 headwater streams. Based on our annual mapping of habitat disturbances related to shale-gas extraction, shale-gas development was minimal in 2008 but has increased annually since that time. In this presentation, we will compare the spatially explicit response of selected avian species over time and relate the response to habitat change that resulted from development of shale-gas infrastructure (well pads, roads, pipelines). For example, abundance and distribution of *Setophaga cerulea* (Cerulean Warbler) have declined $\approx 40\%$ but that of *Helmitheros vermivorum* (Worm-eating Warbler) only slightly. *Molothrus ater* (Brown-headed Cowbird) increased substantially from initially occurring at almost no points to occurring at $\approx 25\%$ of points in 2013. At the same time, we documented parasitism of waterthrush nests in 2013 by cowbirds; no nest parasitism was noted before 2013. Early in the study (2009–2011) when little shale-gas activity had occurred, nest survival within territories classed as impacted by shale-gas development (43.2%; $n = 39$) was similar to unimpacted territories (46.7%; $n = 84$). However, habitat-quality indices were lower for nests in shale-gas-impacted territories suggesting that habitat quality had declined. Data from 2013 are currently being analyzed, and will be included in the presentation.

Tue-PM1-A-1

Dormancy Response Patterns of Deciduous Forest Communities in New England

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Abstract - Plant phenological changes in recent decades across temperate forest regions, such as earlier leafing in the spring or later leaf senescence in the fall, indicate a dramatic biological response to climate change. While mechanisms of spring phenology (bud burst, leafing out, and flowering) have been well studied and integrated into predictive models of future responses to climate change, it is still unclear how fall phenology in plants (leaf senescence and dormancy) responds to environmental variation. Plant physiological studies suggested a list of environmental changes or stressors during the growing season that appear to be related to phenological change in fall. However, the role of different environmental triggers and how they interact in different species to produce observed fall phenological patterns remains unknown. Based on remotely sensed phenology data, we detected multiple significant effects of temperature, precipitation, and other weather stressors on the timing of dormancy of deciduous forests communities in New England from 2001 to 2010 using a Bayesian Model Averaging regression method. The timing of deciduous forest dormancy responds not only to decreasing temperature in fall, but also to precipitation, drought, frost, heat, and extreme weather events during the growing season. Among those factors, cold degree days (CDD) had the highest contribution to dormancy-date variation. Higher CDD, elevation, more frost days, and increased heat lead to earlier dormancy dates. The effects of summer and fall precipitation on dormancy dates were not linear, while spring precipitation and drought had negative effects. Deciduous forests in the northeastern highlands, which are dominated by maples and birches, have higher sensitivity to weather-condition changes than forests in coastal areas that are dominated by oaks. Additionally, summer precipitation interacted with heat effect leading to later dormancy dates of forests in coastal areas. The results suggest a complex mechanism of spatiotemporal fall phenology responses and different significant abiotic factors for different forest communities. Our study improves the understanding of fall phenological responses to variation in weather patterns in temperate forest communities and provides a way to build predictive models of future responses to climate change.

Tue-AM1-C-1

Watershed-scale Adaptation Strategies for Climate Change

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Abstract - Many urban areas face serious problems concerning storm water as urban impacts on hydrologic processes increase. These effects are often enhanced by climate change as hydrologic processes are intensified. Adaptation strategies are needed to reduce these impacts through retrofitting “gray infrastructure” with “green infrastructure”. Instead of intensifying built environments, existing drainage and water-storage infrastructure can be augmented with the establishment and strengthening of green infrastructure. These strategies need to be developed by taking into consideration watershed-system processes. The objective of this study is to review alternative strategies and efficacy in achieving integrated storm-water management using a case study in a large city in China. Specifically, we sought to assess a combination of practices that could be used to enhance the natural runoff-management capacity of urban watersheds. We focused on temporarily runoff storage, “green” sewer systems, treatment of secondary urban-watershed pollution, and drainage for urban flood protection that are based on restoring watershed structure and function. Some of the keystones to these alternative approaches are land-use efficiency, urban diversification, and ecological restoration. The findings of this case study indicate that the implementation of integrated adaptation strategies at a watershed scale can be used to mitigate climate change in urban watersheds. Public and private spaces for water can be designed to be hydro-sensitive and thus more resilient to climate change.

Wed-AM1-D-1