TENTH RESEARCH SYMPOSIUM
JUNE 26, 2017
BLACK ROCK FOREST CONSORTIUM

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Black Rock Forest Consortium was formed in 1989 to promote scientific research, education, and conservation in the 4000-acre Black Rock Forest in southeastern New York State. Since 1999 the Consortium has hosted a Research Symposium in late June of every second year. The purpose of the Symposium has been to communicate research taking place in the Forest and to provide a venue for investigators to meet and discuss their work. Since 2007 the Symposium has also included presentations about research elsewhere in the Highlands region.

TALKS

William Schuster, Black Rock Forest Consortium, "*Tree community response to oak loss*."

Ed McGowan, PIPC/OPRHP, "*Historical changes in the herpetofauna of the Hudson Highlands."*

Kevin Griffin, Columbia University, "*Digital tree dendrometer network- update and results to date."*

Terryanne Maenza-Gmelch, Environmental Science, Barnard College, Columbia University, NY and **Marissa Wasmuth**, Environmental Science, Barnard College, NY, *"Impact of various road types and trails on bird abundance and diversity at Black Rock Forest, Hudson Highlands, New York."*

Sydne Record, Bryn Mawr College, **Tempest McCabe**, Bryn Mawr College, **Benjamin Baiser**, University of Florida, and **Aaron M. Ellison**, Harvard University, *"Are foundation species effects different than those of dominant species? A case study of ant assemblages in northeastern North American forest."*

Mark Siddall, American Museum of Natural History, "*Study of local leech infestations opens a whole can of worms."*

Matt Palmer, Columbia University, "*Understory response to oak loss and herbivore exclusion."*

Shahid Naeem, Columbia University and Earth Institute, **Case Prager**, Columbia University, **Brian Weeks**, Columbia University, **Alex Varga**, Earth Institute, **Dan F.B. Flynn**, Arnold Arboretum, **Kevin Griffin**, **Robert Muscarella**, **Matthew Palmer**, Columbia University, **Stephen Wood**, Columbia University and Yale University, **William Schuster**, Black Rock Forest Consortium. *"Biodiversity as a multidimensional construct: A review, framework, and case study of herbivory's impact on plant biodiversity."*

Alan W. Wells, Della M. Wells, Nancy Slowik, Karen Nickeson, and **John Lampkin** PIPC League of Naturalists, "*A year in the life of Lily Pond."*

Kristy King, NYC Parks, **Clara Pregitzer**, Natural Areas Conservancy, **Helen Forgione**, Natural Areas Conservancy, **Sarah Charlop-Powers**, Natural Areas Conservancy, **Jennifer Greenfeld**, NYC Parks, *"A framework for data-driven forest management in New York City."*

Angelica E. Patterson, Columbia University/LDEO, **Rachel Arkebauer,** Columbia University E3B, **Crystal Quallo,** Columbia University/Barnard College, **Mary A. Heskel,** Marine Biological Laboratory – The Ecosystems Center, **Ximeng Li**, Hawkesbury Institute, **Natalie Boelman**, Columbia University/LDEO, **Kevin L. Griffin**, Columbia University/LDEO, *"Temperature response of respiration and respiratory quotients of sixteen co-occurring temperate tree species: a comparison among historic range distributions."*

Alexis L. Brewer, and **Jose D. Anadon**, The Graduate Center, CUNY, "*The effects of urbanization on scavenging behavior*."

Elijah Goodwin, Rockefeller State Park Preserve and Whimbrel Nature, "*Of birds and beeches: Wood Thrush productivity at Rockefeller State Park Preserve*."

Adriana Joazeiro de Baker, Teachers College, "*Results from studies of student engagement in Black Rock Forest."*

Max Garfinkle, New York State Parks Office of Parks, Recreation and Historic Preservation, "*Vermivora in the Western Hudson Valley: Findings and Habitat Management 2013-17."*

Emy Metzger, Barnard College, "*A study on climate's effect on xylem cell division in hemlocks, red oaks, and red pines in Black Rock Forest*."

Stephanie Schmiege, Columbia University E3B, *"The effect of canopy (light) levels on respiration in white spruce (Picea glauca)."*

Nurit Kedir, Columbia University E3B, **Kevin Griffin**, Columbia University E3B, LDEO, **Stephanie Pfirman**, DEES, Barnard, Columbia LDEO, "*Respiratory quotient analysis of conifer tree species in Black Rock Forest."*

POSTERS

Nora Gmelch, Monroe Woodbury High School, "*Looking for Batrachochytrium salamandrivorans in soil samples from salamander habitats at Black Rock Forest, NY*"

Cadet Alaina Kappner, **Cadet Hugh McConnell**, United States Military Academy, "*Changes in Black Rock Brook fish community within Hudson Valley Watershed after Hurricane Irene*."

Prithi Chakrapani, Hunter College High School, **Isabel Ojeda**, The Brooklyn Latin School, **Dominique Tjondro**, Townsend Harris High School, **Mali'o Kodis, Christopher Raxworthy**, American Museum of Natural History, *"Tracking the turtles of Black Rock Forest."*

Mathieu Levesque, **Laia Andreu-Hayles,** Columbia University, Lamont-Doherty Earth Observatory, Tree Ring Laboratory**, Neil Pederson**, Harvard University, "*High sensitivity of broadleaf trees to water availability in northeastern US."*

Ella Merrill, Barnard College, "*Estimating the biomass of black birch trees in Black Rock Forest, NY. "*

Terryanne Maenza-Gmelch, Barnard College, *"Hudson Highlands West Important Bird Area: Harriman and Sterling to Black Rock and Storm King, New York.*

Max R. Piana, Rutgers University, "*Barriers to urban forest recruitment: comparing urban and rural seed predation rates and species preference."*

ABSTRACTS

Tree community response to oak loss

William Schuster (Black Rock Forest Consortium)

Oak trees comprise about 70% of the aboveground biomass of Black Rock Forest, dominate many forests of the eastern United States, and have done so for thousands of years. Oaks absorb carbon faster and sequester it for longer than other trees, oak forests retain nitrogen more than other forest types, and a host of organisms are adapted to oak trees and forests. However, they are under threat through much of their range due to regeneration failure, spreading pathogens and several other challenges. The Future of Oak Forests experiment was initiated 10 years ago to assess what the implications of oak loss would likely be on a suite of ecosystem processes, services, and native organisms. On a series of experimental plots in 2008 either all oak trees were girdled with a chain saw to mimic death by pathogen (OG), half of the oaks were girdled (O50), or all non-oaks were girdled (NO), and another set of plots were studied but left alone to serve as controls (C). Plots measure 75 meters on a side with a 15 meter by 5 meter deer enclosure on each plot. Oak girdled plots had higher light penetration, cooler and moister soils, lower soil respiration and higher nitrogen availability compared to controls. On O50 plots, among non-oaks, black birch showed the greatest biomass increase while sugar maple showed the greatest relative biomass increase. On OG plots non-oaks grew 8 times faster than on control plots and these plots are now dominated by sugar maple with red maple showing the greatest relative biomass increase. In the understory witch hazel has exhibited much faster growth on OG plots and will undoubtedly influence which tree seedlings are able to establish and grow into trees. Tree seedlings are more numerous on OG plots compared to control plots and much more diverse, especially within deer exclosures. If all oaks succumb to a pathogen we project a huge loss in carbon storage and uptake that will persist for a long time. We project that existing sugar and red maple trees will become the new canopy dominants but this may be temporary because sugar maple is failing to regenerate and seedling cohorts are dominated by red maple, tulip poplar, and black birch. The results from inside deer exclosures, however, indicate that if deer density can be controlled, a more diverse suite of trees including chestnut and red oak along with birches, tulip poplar and maples will establish in the understory and may comprise the new canopy.

Historical changes in the herpetofauna of the Hudson Highlands

Ed McGowan (Palisades Interstate Park Commission, Trailside Museums and Zoo)

The varied physiognomy and habitats of New York's Hudson Highlands support a diverse herpetofauna, including several species occurring near the southern or northern limits of their continental ranges. I examined naturalist records from three different time periods (Edgar Mearns – late nineteenth century; Trailside Museum and American Museum of Natural History – 1930-1975; and NYS-DEC Herp Atlas Project and Palisades Interstate Park League of Naturalists – 1976-present) for evidence of qualitative changes in species abundance, local extirpations, and new arrivals within the study area. Of 46 species recorded during the first two survey periods, records suggest six species are now extirpated, or at least reduced below detectable levels. These include spadefoot toad, leopard frog (sp?), spring salamander, Allegheny dusky salamander, bog turtle, and mud turtle. Two snake species (eastern hognose, and eastern ribbon) reported as common by Mearn's in 1898 are now uncommon within the study area, while a third species, the smooth green snake, may be facing extirpation. The northern cricket frog, which went undetected Mearns but was recorded in three watersheds during the middle period, is now restricted to one extralimital site. Only the black rat

snake and timber rattlesnake appear to have more stable populations today than in Mearns' time, when he described both to be formerly more numerous but, by the late nineteenth century, already quite rare. New arrivals since the earliest time period are dominated by lake and pond turtles, including red-eared slider, northern red-bellied turtle, and eastern spiny softshell turtle.

Digital tree dendrometer network- update and results to date

Kevin Griffin (Columbia University)

We established a digital tree dendrometer network in Black Rock Forest to monitor tree growth and environmental conditions in near real time. The network relies on simple linear-motion potentiometers affixed to the trees in such a way that they continuously record changes in tree diameter. Currently our network consists of 10 red oak trees, five at each of two sites, and a third site with three red pine and three hemlock trees. The sensors are hardwired to a remote datalogger that uses a radio frequency to transmit the data back to Black Rock Forest Science Center. The data are streamed to the web by the Columbia University Center for Teaching and Learning (https://blackrock.ccnmtl.columbia.edu/treegrowth/). Our network has been running since September 2016 with the data continuously reported to the website. The data show that no appreciable diameter growth occurred between September 2016 and April 2017 in any of three sites. During late March, a particularly cold period resulted in freeze-thaw cycles that led to transient changes in diameter which may have been related to xylem refilling. Growth commenced around April 15th in all three sites and continues, with significant changes in stem diameter. These initial results show the "Mt. Misery" site (shown as Site 1 on the web page), is growing faster than the "White Oak" site (shown as Site 2 on the web page), consistent with the long-term growth trends at these two sites. Efforts to develop an inexpensive DIY system were also discussed (http://tree.bio).

Impact of various road types and trails on bird abundance and diversity at Black Rock Forest, Hudson Highlands, New York

Terryanne Maenza-Gmelch, (Environmental Science, Barnard College, Columbia University, NY) and Marissa Wasmuth, (Environmental Science, Barnard College, NY)

Black Rock Forest and surrounding preserves in the Hudson Highlands of New York were designated as an Important Bird Area by Audubon New York in 2016. We are interested in understanding the impacts of various road types and trails on bird abundance and diversity in order to inform land-use decisions in and near this forest for bird conservation purposes. Three sites were targeted for this study: forest near paved road, dirt road and trail. All three sites were similar except for their location in relation to the road type. Five points were randomly established at each site. Each point was visited several times during the period spanning May 18, 2015 to June 30, 2015, totaling 30 minutes at each point. A total of 692 detections were made of 57 bird species in this survey. Measures of bird species richness and Shannon-Weiner Index of Diversity were not significantly different between paved road, dirt road and trail (with 15.2, 19.6, 15.2 mean richness, respectively and 2.61, 2.84, 2.63 mean SW Index, respectively and 176, 312, 204 bird dectections, respectively). All p values were > 0.1. Since the sample size was only 5, we plan to repeat this study next season with more sites. Our results are similar to a previous study done ten years earlier at Black Rock Forest (Rothe et. al. 2005) that determined there were no significant differences in bird diversity and abundance along roads and trails at this forest. Since Black Rock Forest exists in a landscape matrix that is heavily forested in general, it is not surprising that the bird diversity and abundance near roads and trails may not differ significantly. An

expanded analysis (to include more points, a forest interior site away from all roads and trails as a control and a separation of various nesting and foraging guilds) is planned.

Are foundation species effects different than those of dominant species? A case study of ant assemblages in northeastern North American forests

Sydne Record (Bryn Mawr College), Tempest McCabe (Bryn Mawr College), Benjamin Baiser (University of Florida), Aaron M. Ellison (Harvard University)

Foundation species uniquely control associated biodiversity through non-trophic effects, whereas dominant species are locally abundant but are replaceable in ecological systems. Long-term data on ant assemblages at the Harvard Forest Hemlock Removal Experiment (HF-HeRE) and the Black Rock Future of Oak Forests Experiment (BRF-FOFE) provide insights into how ant assemblages change and reassemble following the loss of a foundation species (*Tsuga canadensis*) or a dominant genus (*Quercus*). At HF-HeRE, removal of *T. canadensis* trees resulted in taxonomic and functional shifts in ant assemblages relative to control stands. In contrast, ant assemblages at BRF-FOFE varied little regardless of whether oaks or non-oaks were removed from the canopy. Non-trophic effects of foundation species were stronger than indirect trophic effects on taxonomic and functional diversity of ant assemblages. In contrast, non-trophic effects of dominant species were weaker than indirect trophic effects on ant taxonomic diversity and some measures of ant functional diversity.

Study of local leech infestations opens a whole can of worms

Mark Siddall (American Museum of Natural History)

ABSTRACT NOT AVAILABLE

Understory response to oak loss and herbivore exclusion

Matt Palmer (Columbia University)

ABSTRACT NOT AVAILABLE

Biodiversity as a multidimensional construct: A review, framework, and case study of herbivory's impact on plant biodiversity

Shahid Naeem (Columbia University and Earth Institute), Case Prager (Columbia University), Brian Weeks (Columbia University), Alex Varga (Earth Institute), Dan F.B. Flynn (Arnold Arboretum), Kevin Griffin (Columbia University), Robert Muscarella (Columbia University), Matthew Palmer (Columbia University), Stephen Wood (Columbia University and Yale University), William Schuster (Black Rock Forest Consortium)

Biodiversity is inherently multidimensional, encompassing taxonomic, functional, phylogenetic, genetic, landscape, and many other elements of variability of life on Earth. However, this fundamental principle of multidimensionality is rarely applied in research aimed at understanding biodiversity's value to ecosystem functions and the services they provide. This oversight means that our current understanding of the ecological and environmental consequences of biodiversity loss is limited primarily to what unidimensional studies have revealed. To address this issue, we review the literature, develop a conceptual framework for multidimensional biodiversity research based on this review, and provide a case study to explore the framework. Our case study specifically examines how herbivory by whitetail deer (*Odocoileus virginianus*) alters the multidimensional influence of biodiversity on understory plant cover at Black Rock Forest, New York. Using three biodiversity dimensions (taxonomic, functional, and phylogenetic diversity) to explore our framework, we found that herbivory

alters biodiversity's multidimensional influence on plant cover; an effect not observable through a unidimensional approach. Though our review, framework and case study illustrate the advantages of multidimensional over unidimensional approaches, they also illustrate the statistical and empirical challenges such work entails. Meeting these challenges, however, where data and resources permit, will be important if we are to better understand and manage the consequences we face as biodiversity continues to decline in the foreseeable future.

A year in the life of Lily Pond

Alan W. Wells, Della M. Wells, Nancy Slowik, Karen Nickeson, John Lampkin, (PIPC League of Naturalists)

This year (2017) marks the beginning of the thirteenth year of a phenology study of Lily Pond, a 3-acre pond in Harriman State Park, NY. We present a short photographic tour of the physical, floral, and faunal changes that take place throughout a generalized one-year period around the pond. The presentation will focus primarily on the seasonal changes in the bird, mammal, amphibian, reptile, insect and wildflower communities but will also address some of the physical changes taking place in the pond itself.

A framework for data-driven forest management in New York City

Kristy King (NYC Parks), Clara Pregitzer (Natural Areas Conservancy), Helen Forgione (Natural Areas Conservancy), Sarah Charlop-Powers (Natural Areas Conservancy), Jennifer Greenfeld (NYC Parks)

In 2014, the Natural Areas Conservancy performed an ecological assessment of the health and condition of 10,000 acres of NYC Parks' forests and wetlands in more than 50 parks, one of the largest studies of urban ecology in the nation. This huge dataset revealed valuable and occasionally surprising information about these urban natural areas, including high levels of native diversity and varying patterns of human influence across a wide landscape. In combination with years of operational data from NYC Parks, we have developed a framework for forest management that allows for comparison of diverse forests using standardized metrics as well as priorities and cost estimates for management at multiple scales of intervention. This framework is still in development, but has already yielded allocation of City Capital funding toward forest restoration. Next steps include operationalization of the entire framework, including pre- and post-restoration monitoring to track change in condition over time as interventions occur.

Temperature response of respiration and respiratory quotients of sixteen co-occurring temperate tree species: a comparison among historic range distributions

Angelica E. Patterson (Columbia University/LDEO), Rachel Arkebauer (Columbia University E3B), Crystal Quallo (Columbia University/Barnard College), Mary A. Heskel (Marine Biological Laboratory – The Ecoystems Center), Ximeng Li (Hawkesbury Institute), Natalie Boelman (Columbia University/LDEO), Kevin L. Griffin (Columbia University/LDEO)

The forests of the northeastern U.S. are globally, one of the fastest growing terrestrial carbon sinks due to historical declines in large-scale agriculture, timber harvesting, and fire disturbance. However, shifting range distributions of tree species with warming air temperatures are altering forest community composition and carbon dynamics. Here, we focus on respiration, a physiological process

that is strongly temperature and species dependent. We specifically examined the response of respiration (*R*; CO_2 release) to temperature in 10 broadleaved and six conifer species, as well as the respiratory quotient (*RQ*; ratio of CO_2 released to O_2 consumed) of nine broadleaved species that co-occur in the Hudson Highlands Region of New York, U.S. The relationships between these physiological measurements and associated leaf traits were also explored. The rates of respiration at 20°C were 71% higher in northern ranged broadleaved species when compared to both central and southern ranged species. In contrast, the rates of respiration at 20°C in northern ranged conifers were 12% lower than in central ranged conifers. The RQ of broadleaved species increased by 14% as temperatures increased from 15°C to 35°C. When RQ values were pooled across temperature, northern ranged broadleaved species had 12% and 9% lower RQ values than central and southern ranged species, respectively, suggesting a reliance on alternative (non-carbohydrate) substrates to fulfill respiratory demands. A Pearson correlation analysis of leaf traits and respiration revealed strong correlations between leaf nitrogen, leaf mass area, and *R* for both broadleaved and conifer species. Our findings suggest that under a warming climate, the relatively small coniferous population used in this study will physiologically acclimate to increasing temperatures, while the dominant broadleaved population may not. Compounded with range distribution shifts and species replacement, this may reduce the carbon storage potential of northeast forests.

The effects of urbanization on scavenging behavior

Alexis L. Brewer, Jose D. Anadon (The Graduate Center, CUNY)

Turkey vultures (*Cathartes aura)* and black vultures (*Coragyps atratus)* prevent disease transmission, distribute nutrients, and facilitate energetic movements by breaking down and consuming carrion. These ecosystem services stabilize and provide the foundation for many terrestrial food webs. Vultures are the only obligate vertebrate scavengers in the world but must compete with facultative carnivores for food. However, other scavengers lack the vultures' disease immunity and specialized skills for breaking down carcasses. Urbanization compounds stressors, and scavengers, obligate and facultative alike, must change their behaviors to continue to thrive. Vultures may continue to survive in highly urbanized locations by exploiting anthropogenic foods, including slaughterhouse refuse, fishery discards, and landfills. We propose to study adaptations of vultures to urbanization by quantifying resource competition, dietary composition, and movement patterns along a 400-mile urban gradient stretching from New York City northward into the Adirondacks. Black Rock Forest serves as the exurban study location. We will use a three-pronged approach: (1) we will compare the community composition and interspecific interactions along our gradient using camera trap data, (2) we will analyze vulture movement patterns using geospatial tracking devices, and (3) we will employ a novel use of stable isotope analysis to determine the contribution of anthropogenic foods to the vulture diet. Preliminary results from 2016 Black Rock Forest (less urban) and Louis Calder Center (more urban) show important differences between the two locations, with a lack of vultures closer to larger cities. Initial geospatial tracking results suggest some individuals show an affinity for anthropogenic food sources such as landfills, with a high degree of individual variation. Finally, we hypothesize the stable isotopic analysis will show that the anthropogenic contribution to the vulture diet will mirror our urban gradient. These methods will shed light on vulture ecological adaptations in an increasingly urbanized world.

Of birds and beeches: Wood Thrush productivity at Rockefeller State Park Preserve

Elijah Goodwin (Rockefeller State Park Preserve and Whimbrel Nature)

The ~1552 acre Rockefeller State Park Preserve was designated an Important Bird Area in 2008, in part because of its populations of breeding wood thrush. But does presence and breeding activity really equate with a successful population? Preliminary results from two years of a three year study indicate that wood thrush (and thus other interior understory nesting species) are not producing enough young to sustain their population. Predation is the primary cause of nest failure at the Preserve, but analysis of vegetation around nest sites indicate that the problem is at least partially related to deer overpopulation and over-browsing. This study has important implications for wood thrush conservation, particularly in light of recent published studies suggesting that wood thrush benefit from deer activity and that adult mortality is the primary driver of wood thrush population declines.

Results from studies of student engagement in Black Rock Forest

Adriana Joazeiro de Baker (Teachers College)

ABSTRACT NOT AVAILABLE

***Vermivora* in the Western Hudson Valley: Findings and Habitat Management 2013-17**

Max Garfinkle (New York State Parks Office of Parks Recreation and Historic Preservation)

Prevailing research has shown an intricate connection between landscape usage and genetic separation of closely related species, the Golden-winged warbler and Blue-winged warbler. NYSOPRHP and the PIPC have conducted multiyear studies trying to better understand these dynamics through survey work shedding light on population distribution. Trends anecdotally seen through the analysis of our survey work have tied in to how we have/ will have, effectively managed upwards of 100 acres of "interior" wetland habitat in an effort to bolster Golden-winged populations globally. In 2016, NYSOPRHP was given the opportunity to partner with Constitution Marsh Audubon Center and Sanctuary, Vermont Audubon, the Cornell Lab of Ornithology, and the University of Maine to contribute to better understanding where Golden-winged and Blue-winged warblers of the Appalachian population winter using light level geolocators. 2017 brought eight of the thirteen birds back to the Hudson Highlands, five of those birds we were able to recover the "geos" from. NYSOPRHP and its partners are anxiously waiting for the locator information to be analyzed and hope that the data from this study will help support conservation efforts in their wintering grounds in South/ Central America.

The effect of canopy (light) levels on respiration in white spruce (*Picea glauca*)

Stephanie Schmiege (Columbia University E3B)

Canopy position affects carbon balance in many species due to gradients of environmental variables such as light, temperature and relative humidity. While the effect of light availability on photosynthesis has been well examined, less is known about the effects of the leaf light environment on respiration, particularly respiration in the light. Here, we examine the effects of canopy position and leaf light environment on respiration of white spruce (*Picea glauca*) growing in Black Rock Forest, Cornwall, NY. Using an LI-6800, we collected CO_2 and light response curves in the upper and lower canopy of six white spruce trees. Thus far, preliminary results suggest that upper canopy leaves have higher rates of photosynthesis and respiration in the dark. However, lower canopy leaves may be more efficient at gaining carbon. Neither canopy height showed a discernable difference between

respiration in the light and respiration in the dark. Future work will address this apparent lack of inhibition of respiration in the light.

A study on climate's effect on xylem cell division in hemlocks, red oaks, and red pines in Black Rock Forest

Emy Metzger (Barnard College)

While tree-coring is a technique most commonly used to age trees, tree cores can also provide information about a tree's growth during a specific year of the plant's life. Annual growth can be determined by measuring the width from one tree ring to the next, and determining how much the tree had grown from the previous year. A tree's yearly growth depends largely upon temperature and precipitation, as well as its position in the canopy and basic health. While canopy position and tree health are constant factors, tree growth correlates positively with temperature and precipitation. A tree's growth occurs in the xylem, in which cells divide primarily during the spring season. In Black Rock Forest, electronic dendrometers are used to continuously measure specific trees' growths, thus providing data on current xylem cell division. Using the live feed data provided by the dendrometers in addition to microscopically viewing the most recent xylem cells in these trees, it is possible to correlate the trees' growth patterns with corresponding temperature and precipitation data in the area. With this understanding of how select trees are affected by temperature and precipitation, predictions can be made regarding how climate change, with warmer temperatures and altered precipitation patterns, will impact tree growth in the future.

Respiratory quotient analysis of conifer tree species in Black Rock Forest

Nurit Kedir (Columbia University E3B), Kevin Griffin (Columbia University E3B, LDEO), Stephanie Pfirman (DEES, Barnard, Columbia LDEO)

Black Rock Forest (BRF) contains both broadleaf and conifer tree species whose range distributions are primarily north, central, or south relative to BRF. As such, species from these various distributions found in BRF may have adapted both biologically and physically to the varying atmospheric and ecological conditions existing in this location, such as temperature. This study analyzes respiratory quotient (RQ) of 12 conifer tree species found in BRF and around the Lamont-Doherty Earth Observatory campus. RQ was calculated by determining the rates of CO_2 release and O_2 uptake during dark respiration at 25C. Leaf Mass per Area (LMA) was also evaluated using the dry weight to fresh area ratio. Both RQ and LMA measurements were used as indicators of species level differences and compared to similar measurements of broadleaf species conducted in a previous study. RQ represents potential differences in the metabolic function of the conifer species studied, such as substrates used in respiratory processes. The relationship between RQ and LMA suggests possible species level variation in the links between structure and function. Although RQ is evaluated at a single reference temperature, the differences between species from different range distributions may indicate how changing climatic conditions will affect the future ranges and survivability of these species.

POSTERS

Looking for *Batrachochytrium salamandrivorans* in soil samples from salamander habitats at Black Rock Forest, NY

Nora Gmelch, (Monroe Woodbury High School)

Amphibians all around the world are declining (Martel et al., 2013; Stegen et al., 2017). Some declines are due to climate change (Stuart et al., 2004). Some extinctions are due to habitat destruction (Kiesecker et al., 2001). Pollution and predation are also causing declines (Wake and Vredendberg, 2008). It has recently been discovered that a pathogenic Chytrid fungus is killing salamanders around the world. *Batrachochytrium salamandrivorans* is lethal to salamanders (Martel et al., 2013). It is hypothesized that *Batrachochytrium salamandrivorans* originated in Asia and spread around the world in the pet trade of exotic salamanders (Richgels et al., 2016). The spread of this fungus happens from salamander to salamander and from nonamphibian hosts such as crayfish (McMahon et al., 2013). Salamanders are an important part of the ecosystem and their decline is a cause of concern.

The goals of this research are to: map the pools and ponds in the forest, map salamander species occurrences, determine the pH of each site and compare to the earlier work of John Brady to see if the pools have recovered from their acidified states, and to begin a preliminary look at if *Batrachochytrium salamandrivorans* is in soil samples collected from these salamander and newt habitats.

Changes in Black Rock Brook fish community within Hudson Valley Watershed After Hurricane Irene

Cadet Alaina Kappner, Cadet Hugh McConnell (United States Military Academy)

Man-made barriers in rivers change flow dynamics that can influence fish populations. In 2011, Hurricane Irene destroyed a man-made barrier that altered flow of a stream located in Black Rock Forest, NY. We compared data from before and after the failure in 2010 and 2017 to evaluate the effects of the dam failure on species diversity and size of the fish community. Hurricane Irene returned the stream closer to its natural flow pattern, and thus has changed the habitat that the fish rely on for survival. As such, this study examines the effects of the changed habitat on the populations to determine if the dam significantly affected their species diversity and size. We conducted a fish census using electrofishing techniques in conjunction with Black Rock Forest Consortium and compared data collected in a similar manner from 2010. Due to differences in fish size and distribution, our research determined that the dam failure caused by Hurricane Irene has significantly altered the fish populations within Black Rock Brook.

Tracking the turtles of Black Rock Forest

Prithi Chakrapani (Hunter College High School), Isabel Ojeda (The Brooklyn Latin School), Dominique Tjondro (Townsend Harris High School), Mali'o Kodis, Christopher Raxworthy (American Museum of Natural History)

For over two decades, researchers and students have collected data on painted turtles (*Chrysemys picta*) and snapping turtles (*Chelydra serpentina*) at Black Rock Forest, a 3,838-acre forest and scientific field station in the Hudson Highlands, 60 miles north of New York City. The data has been

preserved over the years, but was disorganized and contained errors and incongruencies. As a result, the data could not be analyzed. This past summer, we spent 3 days at Black Rock Forest along with the SRMP students from AMNH. While there, we set up hoop traps, captured, measured, weighed, and released turtles, and learned about the ecology of the area. Our goal was to sort through all of the turtle data collected from Black Rock Forest between 1997 and 2015, and fix errors and incongruencies. The total number of turtles that migrated was 33. This was 7.6% of all turtles documented. 72.7% of the migrated turtles were male. Male turtles traveled the longest distances between ponds, and female turtles traveled relatively shorter distances. The average mass of female painted turtles was 312 grams. The average mass of male painted turtles was 220 grams. On average, female painted turtles weighed more than males, which is consistent with scientific observations.

High sensitivity of broadleaf trees to water availability in northeastern US

Mathieu Levesque, Laia Andreu-Hayles (Columbia University, Lamont-Doherty Earth Observatory, Tree Ring Laboratory), Neil Pederson (Harvard University)

Temperate deciduous forests of eastern US provide goods and services to millions of people and play a vital role in the terrestrial carbon and hydrological cycles. However, ongoing climate change and increased in CO2 concentration (ca) are expected to alter growth and gas exchange of trees, and ultimately forest productivity. Still, the magnitude of these effects is unclear. A better comprehension of the species–specific responses to environmental changes will better inform models and managers on the vulnerability and resiliency of these forests. We combined tree-ring analysis with $\delta^{13}C$ and $\delta 18O$ measurements to investigate growth and physiological responses of *Quercus rubra* and *Liriodendron tulipifera* in northeastern US to changes in water availability and ca for the period 1950–2014. We found very strong correlations between summer climatic water balance (June–August) and isotopic tree-ring series for $\delta^{13}C$ ($r = -0.65$ and -0.73), and $\delta 18O$ ($r = -0.59$ and -0.70), for *Q. rubra* and *L. tulipifera*, respectively. In contrast, tree-ring width was less sensitive to summer water availability ($r = 0.33–0.39$). Prior to the mid 1980s, low water availability resulted in low stomatal conductance, photosynthesis, and growth. Since that period, pluvial conditions occurring in northeastern US have increased stomatal conductance, carbon uptake, and growth of both species. Further, stronger spatial correlations were found between climate data with tree-ring isotopes than with tree-ring width and the geographical area of the observed $\delta 18O$-precipitation response (i.e. the area over which correlations are > 0.5) covers most of the northeastern US. Given the good fit between the isotopic time series and water availability, the robustness of the hydroclimatic reconstructions in this region could be improved considerably with further isotopic research. Overall, the results indicate that stable isotopes yield valuable climatic and physiological information that could be undetected when using solely tree-ring width.

Estimating the biomass of black birch trees in Black Rock Forest, NY

Ella Merrill (Barnard College)

Forests store carbon by converting it into biomass through photosynthesis. The total aboveground biomass in an area has implications for the carbon-sequestration capabilities of the entire ecosystem. As the species composition of a forest changes, so does the forest's ability to store and cycle carbon. It is therefore important to understand the differences in biomass between tree species, to predict how species succession will affect the forest's carbon-sequestration activity. Black Rock Forest, located in New York's Hudson Valley, is presently 67% oak. Recently, black birch has emerged as a major component of the forest understory, particularly in places where oaks have fallen. These changes will

affect carbon storage. Various equations have been developed to determine the total aboveground biomass of a tree. The purpose of this study is to test two pre-existing equations- one general equation for hardwood trees and one equation developed specifically for black birch trees- for their accuracy in predicting the aboveground biomass of black birch trees in Black Rock Forest, ranging widely in diameter at breast height (1.37 meters). The trees were felled and weighed in the field, and the dry aboveground biomass was calculated using a drying factor. This resulted in an allometric equation, using diameter at breast height, comparable to the two original equations, that can be used to more accurately estimate the biomass of black birch trees in northeast forests similar to Black Rock Forest.

Barriers to urban forest recruitment: comparing urban and rural seed predation rates and species preference

Max R. Piana (Rutgers University)

Urban-rural gradient studies have observed suppressed recruitment of native woody species in urban forests (e.g. Cadenasso et al. 2007; Aronson et al. 2015). While native tree recruitment limitation in urban forests is apparent, limited research has been conducted on the ecological mechanisms responsible for these changes in recruitment dynamics. One hypothesis is that post-dispersal seed predation may be an important determinant of seedling abundance and diversity in urban forests (Zipperer et al. 2007), however there is limited empirical research to support this.

This experiment is the first to investigate urban and rural forest seed predation and tests whether: 1) the rate of seed removal for native and nonnative species is greater in urban than rural forests, 2) seed predators exhibit preference for native tree species. To answer these hypotheses a cafeteria study was conducted to measure seed removal rates of six native and two non-native species that represent a range of seed size and dispersal modes. This experiment is nested within a larger research agenda which seeks to test the impact of urbanization on forest function and recruitment dynamics.