Black Rock Forest Consortium

American Museum of Natural History • Barnard College • Brooklyn Botanic Garden • Browning School • The Calhoun School
Central Park Conservancy • Columbia University • Cornwall Central School District • The Dalton School • Friends Seminary
Marine Biological Laboratory -The Ecosystems Center- • Metropolitan Montessori School • New York-New Jersey Trail Conference
New York City PS/IS 311 • New York City Public School 220 • Newburgh Enlarged City School District
The School at Columbia University • The Spence School • Storm King School • Trevor Day School

FIFTH BLACK ROCK FOREST
RESEARCH SYMPOSIUM

June 25 and 26, 2007

PROCEEDINGS

"Environmental Science of the Highlands"

Co-sponsored by

HENRI
Highlands Environmental Research Institute

and

the U.S. Forest Service

BLACK ROCK FOREST CONSORTIUM
129 Continental Road, NY 12518

Fifth Black Rock Forest Research Symposium
June 25 and 26, 2007

Sessions, Presentation Titles and Authors

DAY ONE

Session I – Watershed Studies

Alexander Smith, R.W. Bode and C.P. Tran, NYS Department of Environmental Conservation, "Biological monitoring and applied research in New York State."

Rick Oestrike and S. Cuppett, Fishkill Creek Watershed Committee, "Recent studies conducted by the Fishkill Creek Watershed Committee (FCWC)."

Simon Gruber, K. Nolan and S. Cuppett, Orange County Water Authority, "Orange County Water Authority- overview of research, planning, and demonstration projects in the Highlands region."

Session II – Biological Diversity

Shahid Naeem, J. Sircely, C. Jouseau, E. Trimarco, T. Osmundson, D. Bunker, and M. Palmer, Columbia University, "Black Rock Forest: What are her roles in contemporary environmental research?"

Catherine Burns and D. Burg, WildMetro, "New York metro area small mammal diversity."

Vladimir Ovtsharenko and A. Tanasevitch, Hostos Community College, CUNY, "Comparative analysis of spider diversity of the Black Rock Forest and the Ward Pound Ridge Reservation (Westchester County)."

Pierre Warny, Western Connecticut State University, "Amphibian and reptile ecology and conservation."

Aaron Ellison, S. Record, A. Arguello and N.J. Gotelli, Harvard University, "Baseline inventory of the ants of the oak removal project: sampling methods and species composition."

Session III – Chemical Cycling

Josslyn Shapiro, H.J. Simpson, W. Schuster and K. Griffin, Columbia University, "Watershed budgets of chloride and sulfate as integrators of ecosystem processes."

Anthony Carpi, A. Frei, D. Filosa, K. Ferguson and J. Cherry, John Jay College and Hunter College, "Quantifying the mercury cycle at Black Rock Forest."

David Evers, Biodiversity Research Institute, "The Mercury Issue – more than just a fish thing."

Session IV – Invasive Species

Rebecca Jordan, D. Mellor and W. Brooks, E, McGowan and J. Ehrenfeld, Rutgers University and Palisades Interstate Park Commission, "Using citizen scientists to collect invasive plant data on public lands."

William Schuster, Black Rock Forest, "Current threats to oak forests."

Gretchen Gary, J.D. Lewis, M. Brown, K. Griffin and W. Schuster, Fordham University, Central Park Conservancy, Columbia University and Black Rock Forest, "A sticky situation: urban sprawl may increase cocklebur invasiveness."

Lindsey R. Milbrath, USDA-Agricultural Research Service, "Arthropod herbivory of exotic swallow-worts (*Vincetoxicum* spp.)."

DAY TWO

Session I- Long Term Biological Studies

Randy Stechert, NYS Department of Environmental Conservation, "Anthropocentric impacts on timber rattlesnake populations in New York and adjacent states."
John Brady and M. Munson, Black Rock Forest, "White-tailed deer of Black Rock Forest 1971-2006."
Edwin McGowan and W. H. Martin, Palisades Interstate Park Commission, "Predator-prey cycles in oak forests: a serpent's tale."
William Schuster, Black Rock Forest, "76 years of forest change in the Black Rock Forest."
James Beemer, U.S. Military Academy at West Point, "From Edgar Mearns to today. Biodiversity of the Hudson Highlands and West Point area from 1870 to 2007."
Alan Wells, LMS, "Iona marsh long term bird study."
John L. Confer, Ithaca College, "Golden winged warbler research in Sterling Forest."
Eric Kiviat, Hudsonia, "Management of long present invasive plants: an optimization approach."

Session II – Mapping and Monitoring

Chris Pray, U.S. Military Academy at West Point, "Vernal pool monitoring on the West Point Military Reservation."
Robert Kakerbeck, U.S. Military Academy at West Point, "Mapping ecological communities of the West Point Reservation."
John Mickelson, USGS National Biological Information Infrastructure (NBII), Northeast Information Node (NIN), "Climate change impacts on forested systems in the Northeast: possibilities and spatial dimensions."
Inga P. La Puma and R.G. Lathrop, Rutgers University, "Estimating forest biomass change using kNN in the Highlands of New Jersey."

Session III – Earth, Science, Carbon Cycle

Alec Gates, Rutgers University, "Geologic history of the Highlands."
Dallas Abbott and D. Breger, Columbia University, "Major local and worldwide impact events recorded in sediments from Black Rock Forest."
Jini Gilchrist, Z. Szabo, A. Gates, M. Gorring and M. Lupulescu, Rutgers University, U.S. Geologic Survey, Montclair State University and New York State Museum, "Geochemistry and transport model of AMD at an abandoned sulfide-rich mine in Putnam County, New York."
Christopher Burdette, K. Griffin, M. Palmer and T. Osmundson, Columbia University, "Coarse woody debris dynamics in Black Rock Research Forest of the Hudson Highlands."

Posters

Jennifer Levy and K. Griffin, Columbia University, "Respiration rates in deciduous forests."

Chengyuan Xu and K. Griffin, Columbia University, "Seasonal variation in the temperature response of leaf respiration in *Quercus rubra* at the Black Rock Forest."

Jessie Cherry, A. Frei, A. Carpi, W. Schuster, J. Smerdon, B. Tremblay, M. Munson, J. Brady, and G. Gong, University of Alaska, "Snow research station at Black Rock Forest: long-term monitoring and hydroclimatological research."

Jason Sircely, S. Naeem and W. Schuster, Columbia University, "Evidence for niche-based community assembly in a deciduous forest understory plant community."

Ellen Trimarco, Columbia University, "An observational study of community structure of the forest floor."

Rebecca Steinberg, M. Kelly, J. Schaefer, V. Rinterknecht, R. Schwartz and G. Balco, Barnard College and Columbia University, "Measuring the retreat velocity of the Laurentide ice sheet by cosmogenic nucleides: ^{10}Be dating of glacial features in the lower Hudson Valley."

Deanna Filosa, Allan Frei and Anthony Carpi, John Jay College, "Unraveling the Mercury mystery."

J. Kelly Nolan, Watershed Assessment Associates, "Water quality of the Ramapo River."

J. Kelly Nolan, D. Reed and S. Gruber, Watershed Assessment Associates, "Lotic Scene Investigation (LSI) program for higher education."

DAY ONE

Session I – Watershed Studies

Biological monitoring and applied research in New York State.

A.J. Smith[1,2], R.W. Bode[2] and C. P. Tran[1,2]. [1]New England Interstate Water Pollution Control Commission, [2]New York State Department of Environmental Conservation Stream Biomonitoring Unit

The NYS DEC Stream Biomonitoring Unit has been using benthic macroinvertebrate communities to assess water quality in NYS streams and rivers since 1972. Roughly 2500 sites have been sampled statewide in that time with 89 sites surveyed in the Hudson Highlands specifically. The majority of Highlands sites are assessed as slightly-impaired, followed by moderate, none, and severely impacted. Sources of impairment are predominately from organic and sewage effluent, non-point source nutrient runoff, habitat modification, and erosion/siltation. The Stream Biomonitoring Unit is currently conducting several applied research projects to combat these issues such as: developing nutrient criteria and new methods of evaluating cultural eutrophication, and defining the relationships between land uses and stream water quality. In addition, future perspectives in water quality assessment include the implementation of biocriteria and tiered aquatic life use.

Recent studies conducted by the Fishkill Creek Watershed Committee (FCWC).

Rick Oestrike and S. Cuppett, Fishkill Creek Watershed Committee

The Fishkill Creek Watershed drains approximately 190 square miles within the Hudson River Basin of Dutchess and Putnam Counties. The southern and southeastern margins of the watershed occur within the Hudson Highlands. The FCWC is a volunteer, non-profit, non-advocacy organization that works for the protection of the natural environment within the watershed. The FCWC primarily uses local volunteers but also collaborates with other organizations to protect the watershed, including the Dutchess County Environmental Management Council (DCEMC), NYSDEC, Cornell Cooperative Extension Dutchess County (CCEDC), Dutchess County Water and Wastewater Authority (DCW&WWA), Marist College, and the Institute for Environmental Studies (IES), among others.

In 2004 the FCWC worked with the DCEMC and LHCCD on a grant to conduct a visual assessment of the Fishkill Creek. This study, called Streamwalk 2004, investigated 16 miles of the creek from its mouth almost to its headwaters. More than 477 hours of volunteer time was utilized to characterize the Fishkill Creek and 55 impaired sites were identified and investigated. More than 700 photographs were taken documenting both the typical condition of the creek and various problems. Over 90 GPS coordinates were determined for features including dams, bridges, drainage pipes, areas of severe erosion, and other impairments. Both the photographs and the other information gathered during this project are posted on our website-FishkillCreekWatershed.org. In 2005 a Natural Resource Inventory and Management Plan was published for the watershed, with the work largely done by the DCEMC using grant monies

provided from NYSDEC-HREP. This document summarizes data from earlier studies and presents some new data on water chemistry and macroinvertebrates throughout the watershed. In addition a series of management strategies were created for the protection of the watershed. The committee also collaborated with DCW&WWA on another grant to create curricula for in-stream activities consistent with NYS High School Regents Biology and Earth Science courses. Both the report ant the curricula are posted on our web site.

Other committee activities have included streamside riparian plantings (along with NYSDEC), stream trash clean-ups (along with Scenic Hudson and local municipalities), and canoe trips on the creek and community displays. We are currently working with Dr. Stuart Findlay (IES) on a study of chloride concentrations in both surface and sub-surface waters in the Fishkill Creek Watershed. Information has been distributed to the public through our website and listserve, by interviews on local TV stations, public talks and by articles in local newspapers.

Orange County Water Authority- overview of research, planning and demonstration projects in the Highlands Region.

Simon L. Gruber, Project Consultant, Orange County Water Authority, K. Nolan, Watershed Assessment Associates and S. Cuppett, New York State Department of Environmental Conservation, Hudson River Estuary Program

The Orange County Water Authority is sponsoring several research, planning and demonstration projects that include work in the Highlands region (as defined by the U.S. Forest Service, this includes the towns of Cornwall, Highlands, Monroe, Tuxedo, Warwick and Woodbury in Orange County.)

A county-wide stream biomonitoring study is underway, using benthic macroinvertebrates as indicators of water quality. Approximately 150 sites (including areas outside the Highlands) were sampled during 2004, 2005 and 2006, with some sites sampled in two years. Sampling and analysis is being conducted following the same methodology used by the New York State Department of Environmental Conservation's Stream Biomonitoring Unit for data comparability. This project is being funded with a Federal grant and the final report is due to be released in the fall of 2007. The NYS DEC's water quality categories include a numerical Biological Assessment Profile (BAP) score, from 0-10 (where 10 is the highest water quality) and narrative descriptions: non-impacted (highest water quality), slightly, moderately, and severely impacted. It is important to note, however, that the slightly impacted category includes water quality scores as low as 51% on the BAP scale. Provisional data for sites in the Highlands region indicate 11 non-impacted sites, 11 slightly impacted sites, five sites that are slight but near the moderately-impacted level, and one moderately-impacted site.

A watershed plan for the Moodna Creek watershed is being developed with funding from the Hudson River Estuary Program. This plan will include: a summary of existing conditions and trends, identification and prioritization of problems, risks, and opportunities, and recommendations for priority actions and next steps. The planning process includes participation by an intermunicipal advisory committee and is intended to support ongoing intermunicipal collaboration on watershed issues. Key topics being addressed in this plan include water

resources management, including quality and quantity issues, biodiversity, land use, open space, recreation, and infrastructure needs. A draft plan is expected to be released in September 2007 and the final plan in spring of 2008.

Using a combination of Federal and state funding totaling approximately $500,000, the Water Authority is beginning a decentralized wastewater management demonstration project in the Greenwood Lake watershed, where overgrowth of weeds and other impacts of eutrophication are a growing problem. This community is entirely served by onsite septic systems and a centralized treatment system has been projected to be far too costly, so it is believed that decentralized technologies implemented incrementally over time may be a more feasible strategy for providing sustainable wastewater treatment options. Using soils data, lot density, slope, proximity to the lake, and other information, this project will include a GIS-based needs assessment to identify and prioritize areas where septic systems are most likely to be failing or providing inadequate treatment. The project will include construction and monitoring of several demonstration wastewater systems including one serving at least three homes. Because water quality in the lake is impacted by phosphorus and the state has issued a Total Maximum Daily Load plan to address this, phosphorus management is a primary goal of this demonstration project. As part of this project, a similar needs assessment will also be conducted for the Mountain Lodge Park community in Blooming Grove. For more information on these projects contact the author, go to http://waterauthority.orangecountygov.com/ or call 845-291-4861.

Session II – Biological Diversity

Black Rock Forest: What are her roles in contemporary environmental research?

Shahid Naeem, J. Sircely, C. Jouseau, E. Trimarco, T. Osmundson, D. Bunker, and M. Palmer, Columbia University

Three scientific roles are widely recognized for Black Rock Forest. These are, 1) serving a sentinel of environmental change, serving as the outpost at the end of the rural-urban gradient, and 3) serving as living laboratory to test leading theories in ecology, evolution, and environmental biology. Our research group at Columbia University focuses on the latter and we present summaries of five current research projects. (1) The role of biological diversity in ecosystem stability (using moss invertebrate communities as an example). (2) Trait-based modeling of ecosystem functioning (carbon storage of trees). (3) Plant biodiversity and ecosystem functioning (understory vegetation along a resource gradient). (4) Microbial biodiversity and ecosystem functioning (prokaryotic and fungal diversity along a resource gradient). (5) Faunal biodiversity and ecosystem functioning (faunal diversity and litter decomposition). Collectively, these studies, all recently begun, are providing confirmatory evidence that naturally diverse habitats may be more resilient and provide greater magnitudes of ecosystem functioning and services than the more depauperate systems they are being replaced with. These studies demonstrate not only the value of Black Rock Forest as a place for testing theory, but also a place that will provide unprecedented insights into the science of ecology and the environmental value of forests of the North Eastern United States.

New York metro area small mammal diversity.

Catherine Burns and D. Burg, WildMetro

Urbanization is swiftly occurring around the world, and will continue to increase steadily in the coming decades. Understanding wildlife responses to increasing human population density and associated land-use changes is therefore critical to the conservation of flora and fauna across the planet. WildMetro, a small non-profit organization dedicated to protecting nature in metropolitan regions, has conducted three years of field research in the New York metropolitan area to assess the impacts of increasing urbanization on a suite of nocturnal small mammal species. We have used a combination of mark-recapture live-trapping and tracking methods to survey mammal communities in protected areas across the region, spanning the gradient from extremely urban to suburban to rural. Habitat type and patch size both have significant influences on diversity and abundance of the small mammal community, with smaller patches supporting higher densities of small mammals but with a lower overall diversity. Small mammal communities additionally appear to be strongly negatively impacted by the density of white-tailed deer. This research allows us to begin to identify specific habitat types and other characteristics of protected areas that are essential to the conservation of small mammal communities in urban areas, and to identify thresholds of urbanization beyond which small mammals are critically negatively impacted.

Comparative analysis of spider diversity of the Black Rock Forest and the Ward Pound Ridge Reservation (Westchester County).

Vladimir Ovtsharenko and A. Tanasevitch, Hostos Community College, CUNY

ABSTRACT NOT AVAILABLE

Amphibian and reptile ecology and conservation.

Pierre Warny, Western Connecticut State University

This slide-illustrated presentation focused on the 2007 field trip season to survey breeding amphibians and reptiles, including adult and egg mass counts, "north with spring" along the east coast. Emphasis was placed on local New York and tri-state populations in both rural and urban landscapes with discussions on malformed and declining amphibians, parasites, diseases, turtle nest predation, road kill mortality, wetland eutrophication, invasive species and other conservation issues affecting the ecology of amphibians and reptiles.

Baseline inventory of the ants of the oak removal project: sampling methods and species composition.

Aaron Ellison, S. Record, A. Arguello and N.J. Gotelli, Harvard University

Ants are key indicators of ecological change, but few studies have investigated how ant assemblages may respond to dramatic changes in vegetation structure in temperate forests. Pests

and pathogens are causing widespread loss of dominant canopy tree species; ant species composition and abundance may be very sensitive to such losses. Prior to the experimental removal of red oak trees to simulate effects of sudden oak death and examine the long-term impact of oak loss at the Black Rock Forest (Cornwall, New York), we carried out a rapid assessment of the ant assemblage in the 10-hectare experimental area. We also determined the efficacy in a northern temperate forest of five different collecting methods – pitfall traps, litter samples, tuna-fish and cookie baits, and hand collection – routinely used to sample ants in tropical systems. A total of 33 species in 14 genera were collected and identified; the myrmecines *Aphaenogaster rudis* and *Myrmica punctiventris*, and the formicine *Formica neogagates* were the most common and abundant species encountered. Ninety-four percent (31 of 33) of the species were collected by litter sampling and structured hand sampling together, and we conclude that in combination, these two methods are sufficient to assess species richness and composition of ant assemblages in northern temperate forests. Using new, unbiased estimators, we project that 38-58 ant species are likely to occur at Black Rock Forest. Loss of oaks from these forests may favor *Camponotus* species that nest in decomposing wood and open-habitat specialists in the genus *Lasius*.

Session III – Chemical Cycling

Watershed budgets of chloride and sulfate as integrators of ecosystem processes.

Josslyn Shapiro, H.J. Simpson, W. Schuster and K. Griffin, Columbia University

We compiled input-output chemical budgets for the Cascade Brook watershed in the Black Rock Forest of the Highlands Province to explore the biogeochemical functioning of the ecosystem. We found a prominent seasonal cycle in precipitation concentrations of chloride and sodium, likely due to a higher frequency of marine storm events in winter. The ratio of chloride to sulfate showed an opposite seasonal trend, with 24% more chloride deposited annually than would be predicted from the marine ratio of these ions. We estimate that 64% of this excess chloride deposition comes from sea-salt dechlorination, produced by the interaction of sulfuric and nitric acids in the atmosphere with sea salt aerosols, deposited inland. A further 29% of the excess chloride appears to be derived from HCl released during coal combustion, and 5% from waste incineration. Stream chloride concentrations are several times higher than concentrations in precipitation indicating that dry deposition contributes substantially to total deposition. Nevertheless, chloride concentrations in Cascade Brook are only in the 1.5 – 2.5 mg/l range, reflecting the absence of road salting and wastewater effluent within the watershed, compared to reported values of 20 – 100 mg/l in other mid-Hudson tributaries. There was a significant decreasing trend in precipitation sulfate, hydrogen ion, and nitrate concentrations between 1981 and 2003, concomitant with regional and national emissions reductions due to air pollution controls. Annual export of sulfate in streamwater from Cascade Brook substantially exceeds the sum of measured wet deposition plus modeled dry deposition based on data from a NOAA AIRMoN station previously located adjacent to the Black Rock Forest. Thus dry deposition may have been underestimated by this approach and/or there may be significant sulfate desorption from watershed soils and/or mineralization of organic materials deposited previously when sulfate inputs were higher.

Quantifying the mercury cycle at Black Rock Forest.

Anthony Carpi[1], A. Frei[2], D. Filosa[1], K. Ferguson[2] and J. Cherry[3]. [1]John Jay College, City University of New York (CUNY), [2]Hunter College, CUNY, [3]IARC, University of Alaska

Mercury pollution remains the leading cause of advisories on fishing resources in the United States and it is the only pollutant for which the number of advisories continues to increase. Mercury is transported via a complex biogeochemical cycle that facilitates the long-range transport and deposition of industrial and natural mercury emissions, thus confounding efforts to control the pollutant. In an attempt to quantify the mercury mass balance of the Black Rock Forest ecosystem, we have begun a comprehensive monitoring program at the Black Rock Research Forest. Downward wet depositional fluxes of mercury are being assessed at a Mercury Deposition Network monitoring site established in October 2006, and located approximately 6 miles from the old headquarters at a NADP site. Downward dry depositional fluxes are being estimated by monitoring the accumulation of mercury on laboratory samples transported to the Forest and exposed to dry deposition on site. Fluxes of mercury from the surface are being monitored using a dynamic flux chamber in combination with a cold vapor atomic fluorescence spectrometer. Over the course of the coming year we aim to quantify total fluxes of mercury through the ecosystem towards establishing a mass balance of the metal in the system.

The Mercury issue – more than just a fish thing.

David Evers, Biodiversity Research Institute

ABTRACT NOT AVAILABLE

<u>Session IV – Invasive Species</u>

Using citizen scientists to collect invasive plant data on public lands.

Rebecca Jordan[1], D. Mellor[1], W. Brooks[1], E, McGowan[2], and J. Ehrenfeld[1]. [1]Rutgers University, [2]Palisades Interstate Park Commission

Citizen science activities provide the public with opportunities to learn ecology in non-traditional settings. We employed citizens to document the occurrence of invasive plants in forested public lands along the NY-NJ border. Given the ecological implications of species invasions, we used this opportunity to not only investigate the ability of participants to collect meaningful data, but to also study learning. Specifically, we investigated the extent of invasive plant and ecosystem knowledge, participant views of scientific experimentation and evidence-based reasoning, and participant attitude toward ecologically oriented environmental problems and the role of scientists in providing solutions. Fifty-eight volunteers surveyed 26 miles in both Harriman and Ringwood State parks. A total of 2857 observations were made. 61% of the observations in Harriman State Park and 91% in Ringwood State park were of invasive plants. Japanese Barberry was the most common invasive plant in Harriman State park and Garlic Mustard was most common in Ringwood State park. Volunteers reported that they enjoyed learning about the invasive plant issue. Many plan to talk to others about this issue. In addition, volunteers plan to

change their gardening habits and to remove invasive plants from their yard. In all, each volunteer indicated that they would volunteer for a project like this again. This project is funded by the United States Department of Agriculture and is a partnership between Rutgers University and the NY-NJ Trail Conference.

Current threats to oak forests.

William Schuster, Black Rock Forest

Many forests in the Highlands region, including the Black Rock Forest, have been maturing for several decades, accompanied by a host of other changes. Average tree size has increased substantially, in part due to a dearth of tree regeneration. Seedlings of native tree species remain numerous but few have been able to establish successfully as tree saplings. In recent years canopy tree mortality has increased substantially. Proximal causes have included fires, wind/ice storms, and the decimation of eastern hemlock by the introduced hemlock wooly adelgid. But many canopy oak trees have exhibited dieback and decline in the absence of these direct agents. Mortality has been greatest on poorer sites with rocky soils, suggesting widespread tree stress in these areas, exacerbated by periodic droughts, has resulted in mortality. The introduction of exotic pests and pathogens, further climate changes, and likely increases in logging as remaining canopy trees become more valuable, all threaten the future health and viability of these forests. Dominant or "foundation" tree species play critical and often controlling ecological roles in these forests. Losses of foundation species such as oak trees may impact critical ecosystem services including the provision of high quality water, oxygen, climate control, timber and other forest products, and could alter Lyme disease prevalence and lead to other human health concerns. A multi-investigator experiment in underway in the Black Rock Forest to determine the ecosystem-level consequences that would be associated with the loss of oaks from regional forests.

A sticky situation: urban sprawl may increase cocklebur invasiveness.

Gretchen Gary[1], J.D. Lewis[1], M. Brown[2], K. Griffin[3] and W. Schuster[4]. [1]Fordham University, [2]Central Park Conservancy, [3]Columbia University, [4]Black Rock Forest

Changes in propagule pressure may be a key factor driving the disproportionate abundance of invasive plants in urban compared to more rural areas. Yet, few studies have examined whether seed production or offspring vigor varies with urbanization. Complementary field and greenhouse studies were conducted to investigate how growth, reproductive output, resource allocation to reproduction and offspring vigor vary in an annual, invasive plant, *Xanthium strumarium* L., with increasing distance from an urban center. Individuals of *Xanthium strumarium* were planted at four sites ranging in urbanization from the urban Central Park in New York City to rural Ashokan Reservoir in the Catskill Mountains. In general, vegetative biomass production, reproductive output, and fruit N content and concentration were highest at Central Park and lowest at Ashokan. To examine site-related environmental maternal effects on offspring vigor, fruit randomly collected from representative maternal plants from each site were germinated and grown in a greenhouse. Each seedling was chosen at random to receive either a high, intermediate or low water treatment for 45 days after emergence. Due to low germination percentages, plants from the two most rural sites, Black Rock Forest and Ashokan, were

combined to represent a single "exurban" site. Seedlings from the two most urban sites emerged, on average, four days earlier than those from the two most rural sites. Irrespective of maternal growth environment, decreasing water availability was associated with shorter shoots, fewer leaves and less aboveground and belowground biomass. Seedlings from maternal plants grown in Central Park were significantly larger than seedlings from maternal plants grown at the other sites, suggesting that offspring vigor may differ between plants grown in urban and rural areas. These results suggest that cocklebur may grow faster, produce more seeds, and have increased offspring vigor in urban areas than in rural areas. Because increases in growth rate and increased propagule production may increase the invasiveness of invasive plants in urban areas, these results highlight the need to focus urban plant invasion research not only on disturbance, but also on other environmental factors that may influence plant growth and offspring vigor.

Arthropod herbivory of exotic swallow-worts (*Vincetoxicum* spp.).

Lindsey R. Milbrath, USDA-Agricultural Research Service

Exotic swallow-worts (*Vincetoxicum rossicum* (Kleopow) Barbar., pale swallow-wort, and *V. nigrum* (L.) Moench, black swallow-wort) are herbaceous, perennial, twining vines related to milkweeds (Apocynaceae). Pale swallow-wort is native to Ukraine and southeastern European Russia; black swallow-wort is native to southwestern Europe. Both species are becoming increasingly invasive in the northeastern United States and southeastern Canada, producing large, dense stands capable of reducing floral and faunal diversity. They grow in both high and low light environments in a variety of disturbed and undisturbed habitats. Mostly anecdotal data indicate little to no damage to swallow-wort by arthropods (insects and mites), diseases or vertebrates such as deer. Arthropod surveys were conducted the past two years at multiple sites in New York. Plants from both open field and closed-canopy habitats were visually examined and dissected for arthropods every 2-3 weeks during the summer. We have found only eight generalist species of insects and mites capable of developing on pale and/or black swallow-wort. All were present on the leaves and stems and were usually not abundant. No insects or mites were observed feeding in the root crown, stems or on follicles. Both swallow-wort species experienced no to very minor damage, which may be a contributing factor in the increasing invasiveness of these exotic weeds.

DAY TWO

Session I – Long Term Biological Studies

Anthropocentric impacts on timber rattlesnake populations in New York and adjacent states.

Randy Stechert, NYS Department of Environmental Conservation, Timber Rattlesnake Consultant

Despite being state-listed as a threatened species in 1983, and therefore protected from “taking” by Endangered and Threatened Species regulations, timber rattlesnake populations in New York

and range- peripheral states continue to decline due to a variety of escalating human pressures. Habitat fragmentation from explosive residential development, particularly in Rockland, Orange and Dutchess Counties, New York, Bergen, Passaic, and Morris Counties, New Jersey, and Pike County, Pennsylvania, constitutes the greatest threat to the future integrity and genetic viability of rattlesnake populations on privately owned lands. Further erosive impacts stem from road construction, a resurgence of the mining and quarry industry, and expanding commercial energy programs such as the Millennium Pipeline Project and the proposed New York Regional Interconnect (NYRI) transmission line. Under the current administration's energy initiative policy, these two projects have tacit approval from the Federal Energy Regulatory Commission (FERC), and thus are exempt from the environmental review process. Numerous wind generator projects are also expected to be approved. Sections of these projects traverse a number of timber rattlesnake overwintering den areas and basking-gestating habitat. On a smaller scale, single homes or hunting lodges built in the vicinity of dens and/or basking areas can destroy critical habitat and cause the eventual extirpation of the indigenous rattlesnake colony from human-incurred attrition. In recent years, site-specific locality information available on the internet has led to a rash of amateur herpetoculturists seeking to capture individual specimens for their home collections. With a few exceptions, only rattlesnake populations with dens located $\geq$ one mile inside the boundaries of protected state park and conservation lands will remain genetically viable into the next century.

White-tailed deer of Black Rock Forest 1971-2006.

John Brady and M. Munson, Black Rock Forest

The population trends of deer have been followed through many environmental stresses. Comparing deer numbers to known years of drought, winter severity, and insect defoliation reveal the long-term supporting capacity of the Black Rock Forest. The short-term driving force of mast crops has been measured since 1996. Corroborated with biological data from deer harvests since 1984 and winter tracking censuses since 1995, the Black Rock Forest deer herd data provide insights to influence future forest management plans.

Predator-prey cycles in oak forest: a serpent's tale.

Edwin McGowan and W. H. Martin, Palisades Interstate Park Commission

Acorn crops function as "keystone" resources in oak forests through their effects on mast-consuming rodent populations. Natural fluctuations in acorn abundance are likely to have repercussions for rodent predators. We examined effects of acorn crops on the timber rattlesnake (*Crotalus horridus*), a widely distributed predator of small mammals in eastern oak forests, using long-term (ca. 30 yr) records of rattlesnake reproductive output (litters seen/yr**)** and acorn production for the same time period and geographic area. Midway through the study, a widespread outbreak of the gypsy moth (*Lymantria dispar*), an invasive pest that curtails acorn production, provided a natural experiment for comparing patterns of rattlesnake reproduction in an intact oak forest (pre-gypsy moth) with those in a badly disturbed and acorn-limited environment (gypsy moth impacted). We predicted that a large acorn crop in year *i* would lead to greater prey availability and a peak in rattlesnake mating in year *i*+1. An increase in

rattlesnake reproduction would be expected in year *i*+2 due to long-term sperm storage and delayed ovulation in *C. horridus*. Conversely, we predicted that acorn failure in year *i* would limit rattlesnake reproduction in year *i*+2. Consistent with these predictions, we found a significant correlation between the rattlesnake reproduction index and the red oak (*Quercus rubra*) acorn crop from year *i*-2 during the 17 years prior to gypsy moth impacts. Significantly, the highest and lowest rattlesnake reproduction indices overall followed the largest and smallest acorn crops, respectively, by the predicted 2-year lag. After the arrival of gypsy moths, rattlesnake reproduction was less variable, offering further evidence for this tri-trophic interaction (mast, rodent, rattlesnake**)** in the eastern oak-forest community.

76 years of forest change in the Black Rock Forest.

William Schuster, Black Rock Forest

Forest tree growth and stand dynamics have been recorded on a large number of plots within the 1530 hectare Black Rock Forest since 1930. Relevant regional ecological background factors include the extirpation of most large carnivores by the early 20th century, the initiation of aggressive fire suppression, and the loss of previously-dominant American chestnut between 1915 and 1920. Average stand age in 1930 ranged from 20 to 50 years and most stands had been cut repeatedly. Basal area averaged 14 square meters per hectare with an estimated mean aboveground biomass of 73 metric tons per hectare. Composition was dominated by red, chestnut, white and black oaks with red and sugar maple, gray and black birch, basswood and white ash also common. As the forest matured, density decreased from an average of 1450 trees per hectare in 1930 to 1100 trees per hectare in 1965, declined only slightly over the next thirty years, then decreased again to an average of 750 trees per hectare by 2005. Basal area more than doubled between 1930 and 1998 to 30 square meters per hectare, but declined on a series of long term plots by more than 10% between 1999 and 2005 due to mortality. Before this recent period of canopy tree mortality, for which there is no obvious proximate cause, the greatest periods of tree mortality occurred in the mid-1960s and early 1980s, concomitant with severe drought and extensive gypsy moth defoliation, respectively. The forest canopy has remained dominated by red and chestnut oaks throughout the record, with red oak exhibiting by far the greatest biomass growth of all species. While few seedlings and saplings have succeeded from the understory into the canopy, the composition of the understory has changed dramatically from mixed oak to red maple/black birch. Extensive floristic inventories by Raup in the 1930s and Barringer and Clements during the 1990s, supplemented by forest inventory records, document that American elm, black spruce and paper birch were eliminated from the forest while southern catalpa, slippery elm, red mulberry, white poplar, tree-of-heaven, eastern cottonwood, and cockspur hawthorn became newly established over this period, consistent with an hypothesis that climatic warming has been altering tree ranges and distributions.

From Edgar Mearns to today. Biodiversity of the Hudson Highlands and West Point area from 1870 to 2007.

James A. Beemer, Natural Resources Branch, U.S. Military Academy at West Point

The Hudson Highlands ecoregion of New York State is an area of high biodiversity, a fact that has been known for over 125 years. Edgar A. Mearns, a noted naturalist in the late 1800s and a founder of the American Ornithological Union, published several papers from 1878-1898 detailing the rich biodiversity of the region. By comparing the reports made by Mearns with those species documented by the Natural Resources Branch at the US Army Garrison-West Point and other area surveys, it is noted that biodiversity has remained high and even increased. Changes were noted as more northern species declined while southern species moved in. Comparing numbers of vertebrate species documented the following trends: Birds – 213 spp. Mearns, 251 spp. West Point *et al.*; Mammals – 36 spp. Mearns, 48 spp. West Point *et al.*; Reptiles – 20 spp. Mearns, 25 spp. West Point *et al.*; Amphibians – 20 spp. Mearns, 23 spp. West Point *et al.*; and, Fishes (not including the Hudson River) – 27 spp. Mearns, 42 spp. West Point *et al*. While Mearns did not study other taxa in depth, West Point and others have noted similarly high diversity for vascular plants (~1,200 spp.), odonates (~110 spp.), Lepidoptera (~500 spp.), freshwater mollusks (33 spp.), and spiders (291 spp.). Geology, human land usage patterns, geological history and proximity to the Atlantic coast all contribute to this rich biodiversity and its persistence.

Iona marsh long term bird study.

Alan Wells, LMS

ABTRACT NOT AVAILABLE

Golden winged warbler research in Sterling Forest.

John L. Confer, Ithaca College

The golden-winged warbler (*Vermivora chrysoptera*) is declining at 8.1%/yr in the eastern United States, one of the most rapidly declining vertebrates in this region. Extirpation has occurred throughout much of the golden-wing range in the last half century. Partially this is due to loss of early succession habitat as forests recover and partially this is due to interactions following intrusion of the blue-winged warbler (*V. pinus*) into the golden-wing range.

Generally, blue-wing intrusion is followed by golden-wing extirpation, but not in Sterling Forest State Park where both species have coexisted for over a century. In this park, some golden-winged warblers nest in swamp forests, which provides very high nesting success and which does not have nesting blue-winged warblers co-occupying the same site. Restoration of an upland site to an early succession condition is in progress. Very recently, the site was utilized only by blue-winged warblers. Preliminary results show there are now more nesting golden-winged than Blue-winged warblers. Results also suggest that forest fragmentation in this instance was beneficial because the density of forest birds surrounding the site appears to have increased.

Management of long present invasive plants: an optimization approach.

Eric Kiviat – Hudsonia

ABSTRACT NOT AVAILABLE

Session II- Mapping and Monitoring

Vernal pool monitoring on the West Point Military Reservation.

Chris Pray, Natural Resources Branch, U.S. Military Academy at West Point

In 1998, the United States Army Garrison – West Point initiated a study of the reservation's vernal pool habitats, and the flora and fauna contained therein. In that inaugural year and the following season, 99 pools were mapped and categorized according to their suitability for vernal pool specialists (mole salamanders (*Ambystoma* spp), wood frogs (*Rana sylvatica*), and fairy shrimp (*Anostraca* spp.) as listed in Massachusetts' Guidelines for Certification of Vernal Pool Habitats. The plant lists and physical criteria listed in Guidelines as pool indicators were abandoned as they were poor predictors of where vernal pool specialists would actually breed. Chemical parameters were fairly consistent and suitable for faunal development throughout much of the sample group, except where impacted by road salt. Variables such as surface area, vegetation density, and elevation (0-1200 ft) did not appear to affect pool quality. Disturbance to the basin or surrounding upland, as well as shortened hydroperiod, limited pool success.

The study was replicated in 2000 and 2001, focusing on high quality pools and notable salamander populations and communities. Some pools were downgraded if upland fire damage reduced hydroperiod, while lower quality pools were improved by unintentional earth moving or wetter weather than seen in '98-'99. From 2002 to the present West Point used a variety of techniques to monitor its pools for species of management concern such as the faunal species *Ambystoma opacum*, *A. jeffersonianum,* and *Clemmys gutatta*, and the floral species *Hottonia inflata*, *Carex lupulaformis*, *C. cumulate*, and *C. seorsa.*

Mapping ecological communities of the West Point Reservation.

Robert Kakerbeck, Natural Resources Branch, U.S. Military Academy at West Point

An overview of ecological community types found on the military reservation reveals a patchwork mosaic. A discussion and pictorial presentation of both natural and cultural types classified in a 1993 field survey documented several anomalous types new to Reschke's 1990 New York State report. The rugged topography of the Highlands, diverse post-fire succession, military training, logging operations, and the unique transitional nature of the flora and allied fauna here contribute intricate complexity, ecological beauty, and a challenge to typing and mapping the land.

Future (potential) shifts in natural vegetation of the Hudson River region.

John Mickelson, USGS National Biological Information Infrastructure (NBII), Northeast Information Node (NIN)

Plant communities can change dramatically, over time, in composition, structure, function and integrity. To understand place-specific trends to these systems, adequately detailed baselines of current status needs to be established so that historical and past patterns and processes can be compared to projected or anticipated future changes. Digital geospatial systems (collectively: GIS, GPS, remote sensing, and computer based data systems and software) have aided enormously in our ability to collect, represent and assess spatial patterns in our region ecological systems. Our land cover, habitat and ecosystem databases continue to expand both in quality and content, (thematic and spatial) thus allowing, over time, for the analysis and consideration of increasingly detailed processes. All combine to greatly increase our understanding and optimal stewardship of the resources upon which we depend.

This presentation overviews a range of geospatial research efforts within the greater Black Rock Forest region, which have been helping to fill-in our understanding of:

- how we can improve the thematic and spatial quality of current data representing baseline ecological composition and conditions
- how we can better understand potential natural vegetation patterns for our regions, based on what communities have existed here historically
- how might our understanding of past and current conditions help us to anticipate future changes, such as what climate impacts might induce

This presentation provides an overview of the climate change research underway by the U.S. Forest Service Northern Research Station. This important work seeks to understand potential shifts for 134 forest canopy tree species for the Northeast, in a modeled environment, in the face of a range of climate scenarios and predictions. For more information, see: Prasad, A. M., L. R. Iverson, S. Matthews., and M. Peters. 2007- ongoing. A Climate Change Atlas for 134 Forest Tree Species of the Eastern United States [database]. http://www.nrs.fs.fed.us/atlas/tree, Northern Research Station, USDA Forest Service, Delaware, Ohio.

Estimating forest biomass change using kNN in the Highlands of New Jersey.

Inga P. La Puma and R.G. Lathrop, Rutgers University

The Highlands region in northern New Jersey is composed of a temperate deciduous and mixed coniferous forest matrix. This area has experienced high development pressure and an accelerating rate of forest conversion to urban land uses. The purpose of our project in the Highlands was to estimate the loss of forest biomass associated with forest conversion to urban and transitional uses. This study focused on the efficacy of kNN techniques incorporating satellite remote sensing and a ground-based forest inventory to estimate biomass. 150 forest inventory points were sampled during the 2003 growing season and biomass calculated via diameter-based regressions for North American tree species. We acquired Landsat 5 Thematic Mapper imagery from Aug 25th and Sept 10th, 2003 from the northern New Jersey study area to

correspond with sample collection dates. Normalized imagery from Sept 4th, 1995 was used for retrospective biomass comparisons. We implemented the kNN procedure via a C++ program using a leave-one-out validation module to estimate root mean squared error (RMSE). The best-fit model was derived from a mean filtered Sept 10, 2003 image using k=10 nearest neighbors with no distance decomposition. The resulting model estimated forest biomass with an RMSE of ±104.8 Mg ha^{-1} which was approximately ±51% of the observed mean (205.34 Mg ha^{-1}). Applying the kNN model to a comparable image from 1995 revealed that areas in the Highlands that were considered forest in 1995 and converted to either urban or transitional lands by 2002 had a cumulative biomass loss of approximately 552,755 Mg yr^{-1} over 7 years with an average of 57.71 Mg of loss per hectare.

Session III – Earth, Science, Carbon Cycle

Geologic history of the Highlands.

Alec Gates, Rutgers University

The early history of the Highlands rocks involved sediments being deposited on one coast facing a volcanic arc on the opposite side of an ocean basin about 1.3 Ga. The sediments were muds, sands and limestone reefs and the volcanics were subduction zone-generated andesites interlayered with an apron of sandstone. The two facing continents were proto North and South America and they collided as the ocean basin closed. The collision was the Grenville Orogeny (1.06 to 1.01 Ga) which created likely the largest mountain system ever in the history of the Earth. The collision created huge fold nappes that metamorphosed the rocks into granulite facies gneiss that partially melted creating sheet-like plutons that intruded the nappes. After the main activity, diorite plutons intruded the gneisses about 1,004 Ma. Synchronous with or immediately after the diorite intrusion, a large strike-slip fault system developed in the area and remained active until about 980 Ma. During this faulting, hydrothermal fluids created magnetite deposits within dilational areas of the faults. They were later intruded by pegmatites.

The subsequent history of the Highlands involved rigid body movement and fracture during the three orogenies of the Paleozoic (Taconian (450 Ma), Acadian (390 Ma) and Alleghanian (250 Ma)) and covering by Paleozoic sedimentary rock. It was also fractured during Mesozoic rifting and covered to the southeast by sedimentary and volcanic rocks. Finally, during the Cenozoic, it was subject to glaciation southward to about Morristown, NJ. The only water production in the Highlands comes from the glacial sediments which are largely restricted to the valleys and the fracture systems in the bedrock. Although they can be very productive, fracture systems are very poor purifiers of groundwater. This makes the Highlands less than ideal for water quality.

Major local and worldwide impacts events recorded in sediments from Black Rock Forest.

Dallas Abbott and D. Breger, Columbia University

A core from Tamarack Pond in Black Rock forest has 11 prospective impact ejecta layers that contain Ni rich metal embedded in the surfaces of concoidally fractured grains or marine microfossils. Six out of the eleven layers contain impact glass that has chemistry and

morphology that is inconsistent with volcanic glass. Nine out of the eleven layers contain marine microfossils. Some of the marine microfossils are embedded within the surface of impact glasses. Layer 1 contains a marine microfossil with Ni rich metal splashed on its surface. It has an age that matches an impact off the coast of New Zealand at ~1450 A.D. There are contemporaneous megatsunami deposits in eastern Australia with maximum run ups of 110 meters that may be related to this event. Layer 3 contains a siliceous marine microfossil splashed with Ni rich metal. It has a distal origin, on the order of 10,000 km away at a minimum. Its rough age matches that of a proposed impact onto moon in 1178 A.D. This impact should have produced a shower of impact ejecta that hit the Earth, thereby producing secondary terrestrial ejecta. Layer 5 contains magnetite and magnetic siderite with a concoidal fracture. Its age matches that of an impact event in the Gulf of Carpentaria, Australia at 572±86 A.D. The proximal impact ejecta in the Gulf of Carpentaria contain magnetite impact spherules, magnetic siderite, melted marine fossils, and prospective shocked quartz. The age of the impact in the Gulf of Carpentaria roughly matches that of a prominent climate downturn from 535 to 541 A.D. Layer 8 has an age that matches that of a Long Island tsunami layer [1]. Layer 11 contains impact glass with petrified coccoliths on its surface. Its approximate age matches that of a climate downturn at 1158 B.C. We are now sieving these layers for seeds to C-14 date the layers with more precision. We will also use the sieved samples to look for shocked quartz and feldspar, impact spherules, marine microfossils, and impact glass.
[1] Goodbred, S. L. *et al.*, 2006, Eos Trans. AGU, 2006, OS43C-0681

Geochemistry and transport model of AMD at an abandoned sulfide-rich mine in Putnam County, New York.

Jini Gilchrist[1], Z. Szabo[2], A. Gates[1], Rutgers University, M. Gorring[3] and M. Lupulescu[4].
[1]Rutgers University, [2]U.S. Geologic Survey, [3]Montclair State University, [4]NYS Museum

A geochemical study of a sulfur-enriched U-Th-laced tailings dump at the abandoned Phillips Mine in Putnam County, New York, was conducted to determine the amount of metal pollutants leaching into the water, sediment and soil. The tailings (mine soil) are primarily brownish-yellowish, reflecting the presence of Fe3+-oxides. The oxides may be the dominant secondary minerals for sorption of the metals at the mine dump. Metal enrichment in waters appears to concentrate at pH< 3.0. Chemical analysis of the water and sediment samples collected along a 1.4 km stretch of Copper Mine Brook located below the tailings pile, indicates strongly acidic water (pH 2.25 - 4.06) seeping from the lower adit into the brook. Consequently, very high metal concentrations, including REEs, are abundantly present in the waters. Dilution, due to the confluence downstream between a clean brook and the mine waters, resulted in increased pH that lowered the metal concentrations in waters but progressively elevated metal sequestration in the sediments. Severely deficient in organic matter, mine soil samples, collected along the N-S transect of the tailings dump, were chemically enriched in metal pollutants like La, Ce and Th. The sulfurous mine soil makes the landscape inhospitable for vegetation even after 125 years since cessation of mining operations. However, analysis for metal bioavailability of the roots, twigs and leaves of the sparse vegetation indicates that white birch and mountain laurel are the most adaptable metal-accumulating plant species, storing detectable amounts of REEs + Y that were found in their roots. Mineralogical analysis of the mine tailings suggests that the anomalous abundance of sulfide minerals, particularly pyrite, pyrrhotite, chalcopyrite and marcasite, are the

primary constituents generating acid mine drainage at Phillips Mine.

Coarse woody debris dynamics in Black Rock Research Forest of the Hudson Highlands.

Christopher Burdette, K. Griffin, M. Palmer and T. Osmundson, Columbia University

Coarse woody debris (CWD) consists of both standing dead trees (snags) and material that has fallen to the ground (downed woody debris; large branches and stems). CWD is added to ecosystems by numerous mechanisms, including wind, fire, insect attack, pathogens, competition, and geomorphology. During decomposition, logs and other forms of CWD (defined as wood pieces larger than 10cm in diameter and more than one meter in length) reduce erosion and affect soil development, store nutrients and water, provide a source of energy and nutrient flow, serve as seedbeds, and provide habitat for decomposers and heterotrophs. In 18 sites of Black Rock Research Forest in an oak dominated secondary forest, this study will inventory and classify CWD amongst three dominant species (*Quercus rubra*, *Quercus prinus* and *Acer rubrum*) using field techniques of ranked decomposition class based on observational criteria and laboratory techniques using a CHN elemental composition analyzer and sequential fiber digestion method for fibrous material. The aim of this study is to 1) determine the overall class distribution of CWD, 2) to quantify the nutrient composition and rate of loss from these sources 3) to profile the elemental and fiber content amongst plots and species and 4) determine the effects of woody decomposing fungi on decay class succession. Information gathered in this study will provide an empirical basis for management guidelines and add further clarity to temperate forest ecosystem function.

Posters

Respiration rates in deciduous forests.

Jennifer Levy and K. Griffin, Columbia University

Previous studies have produced estimates of the aboveground carbon stored in Black Rock Forest, however, the belowground component has never been quantified. Therefore, the complete carbon budget for the forest is unknown. This study utilizes a carbon balance approach to measure the total belowground carbon in Black Rock Forest. Measurements of soil respiration, carbon content of the litter, carbon content of the soils, and carbon content of both coarse and fine root systems will be taken and used to calculate the total belowground carbon budget. A model will be developed to reflect seasonal changes in the carbon pools.

Seasonal variation in the temperature response of leaf respiration in *Quercus rubra* at the Black Rock Forest.

Chengyuan Xu and K. Griffin, Columbia University

Leaf temperature responses of *Quercus rubra* were measured throughout the growing season in a deciduous forest, in the upper and lower portions of the canopy at two sites with different soil water availability. Consequently, stand-level canopy foliar carbon loss was modeled for a virtual

Quercus rubra monoculture in these two sites. The base leaf respiration rate of *Q. rubra* was significantly affected by season, water availability, canopy height and their interactions. Upper canopy leaves generally had higher base respiration than lower canopy leaves. At the drier site, a more significant seasonal pattern in base respiration was observed, while at the more mesic site, a stronger canopy position effect was detected. By contrast, the temperature coefficient was constant. Leaf reducing monose could partially explain the seasonality in respiration, and leaf nitrogen was well correlated to the canopy position effect. Canopy respiration of *Q. rubra* was first estimated by a "full distributed physiology model", which integrates the effect of season, site, and canopy position on base respiration. Sensitivity examination indicates that neglecting the season, site and canopy height effects on leaf respiration resulted in up to a 130% error on the estimation of canopy respiration, but canopy level model parameterizations could be simplified by assuming a constant temperature coefficient.

Snow research station at Black Rock Forest: long-term monitoring and hydroclimatological research.

Jessie Cherry[1,2], A. Frei[3], A. Carpi[4], W. Schuster[5], J. Smerdon[2], B. Tremblay[2], M. Munson[5], J. Brady[5], and G. Gong[2]. [1]University of Alaska, [2]Columbia University, [3]Hunter College, [4]John Jay College, [5]Black Rock Forest

The two sites that make up the new snow research station at Black Rock Forest are installed in a clearing in the center of the forest near the Stone House and at the Old Forest Headquarters site. Sensors that are installed at each site include ultrasonic snow depth sensor, longwave/shortwave radiation, up and down, high resolution snow temperature profile, high resolution soil temperature profile, soil moisture at two depths, wind speed and direction, 2m air surface temperature, relative humidity, barometric pressure, precipitation. Communication is handled through a phone line/modem via a Verizon cell tower. Data are housed at the Lamont Doherty Earth Observatory IRI Data Library (iridl.ldeo.columbia.edu). Research questions include: What is the role of snow in regional hydroclimatology? How might this change in the future? What is the role of snow as a regional water resource? Is regional snow monitoring adequate for resource planning? What is the role of snow in the BRF ecosystem? How might this change in the future?

Evidence for niche-based community assembly in a deciduous forest understory plant community.

Jason Sircely, S. Naeem, Columbia University, and W. Schuster, Black Rock Forest

Niche theory and neutral theory provide alternative perspectives on the drivers of species distributions and community composition. Dispersal assembly has modest influence on plant community composition, and its importance is greater at larger spatial scales. Niche theory predicts that environmental variation is associated with niche-based assembly, which explains more variance in composition than dispersal. However, the relative strength of dispersal and niche-based processes on fine-scale assembly has not been assessed in plant communities, partially when distance and environmental variation are confounded. The study site at Black Rock Forest, Cornwall, New York is an oak-dominated forest supporting 120 vascular understory plant species. To infer the importance of dispersal versus niche-based assembly, we

examined fine- to meso-scale (50-400 m) relationships between composition, distance, and environmental conditions in the understory plant community. Distance showed no detectable association with composition, providing no evidence for dispersal assembly. In contrast, environmental conditions were consistently correlated with composition, supporting niche-based community assembly.

An observational study of community structure of the forest floor.

Ellen Trimarco, Columbia University

Several factors are thought to influence decomposition including differences of temperature, composition of organic mater, and structure of decomposer assemblages. Regarding these decomposer assemblages, it is widely documented that a plethora of invertebrates contribute to increased decomposition and nutrient cycling through behavioral mechanisms. We conducted a coarse scale ($25m^2$) observational study of macroinvertebrate and salamander communities and their surrounding leaf litter environment at Black Rock Forest, Cornwall, New York. We wanted to know if the observed invertebrate community structure was actually driving increased carbon storage in the top layer of soil (O and A horizons) and if that community structure was being top-down controlled or environmentally controlled. Although salamander biomass had no effect on macroinvertebrate Shannon diversity, richness or evenness, the percent mass loss of experimental popsicle sticks placed in all plots was significantly related to macroinvertebrate Shannon diversity ($p=.053$) and richness ($p=.004$). Moreover, macroinvertebrate evenness was significantly related to total soil carbon ($p=.002$) and total soil nitrogen ($p=.001$). In addition, the only invertebrate Order that was correlated with any factor by itself (outside of a functional group) was the Araneae ($p=.003$) which were related to the percent mass loss of leaf litter experiments. These results confirm with previous studies that trophic structure of the macroinvertebrate community does, in fact, matter for decomposition processes within Northeastern deciduous forests.

Measuring the retreat velocity of the Laurentide ice sheet by cosmogenic nucleides: ^{10}Be dating of glacial features in the lower Hudson Valley.

Rebecca Steinberg[1], M. Kelly[2], J. Schaefer[2], V. Rinterknecht[2], R. Schwartz[2] and G. Balco[3].
[1]Barnard College, [2]Lamont Doherty Earth Observatory of Columbia University, [3]Quaternary Research Center and University of Washington

Glacial geologic features in the lower Hudson Valley are evidence of the advance of the LIS to its LGM terminus at Long Island and subsequent ice recession. Surface exposure dating (SED) using the cosmogenic nuclide ^{10}Be is applied to date glacially transported boulders and scoured bedrock in two areas in the lower Hudson Valley: Black Rock Forest and Harriman State Park. ^{10}Be and varve-chronology ages are between 2-3 kyr older than ^{14}C dates from lake and bog bottom sediments. Bouldery moraines are highly appropriate for SED as shown by the consistency of ^{10}Be dates from such deposits. No significant delay is shown between the latest stage LGM moraines (Harbor Hill, Charlestown moraines) and recessional moraines (Ledyard and Harriman State Park moraines). Future work will focus on locations further north.

Unraveling the Mercury mystery.

Deanna Filosa[1], Allan Frei[2] and Anthony Carpi[1]. [1]John Jay College, [2]Hunter College

Mercury is deposited from the atmosphere to local ecosystems via both wet and dry deposition. While wet deposition monitoring methods have been in use for several years, measuring dry deposition has remained elusive despite its significance in the global mercury cycle. As part of a larger project to conduct a mass balance of total mercury through the Black Rock ecosystem, we are attempting to estimate dry deposition of mercury using clean surfaces exposed to the local environment. Samples of laboratory grade sand approximately 3 kg in mass are baked overnight at 300°C to remove residual mercury contaminants. These samples are then transported to the Black Rock Forest and exposed to the local environment while being protected from wet deposition using a 1m x 2m polycarbonate sheet suspended approximately 0.5 m above the samples. The samples are then monitored for mercury accumulation using a dynamic flux chamber that measures both dry deposition and emission of deposited mercury from the samples over a period of 35+ days. Preliminary data suggests that the system can effectively track trace depositional fluxes over the course of several weeks. The work presently being done on wet and dry deposition is part of a larger perspective through which we hope to get more insight on environmental factors affecting mercury, what is happening at Black Rock Forest in particular, and possibly utilize the information from this location as a baseline concentration of atmospheric mercury in the Hudson Valley region.

Water quality of the Ramapo River.

J. Kelly Nolan, Watershed Assessment Associates

The water quality data depicted in these graphics was obtained using biological stream monitoring methods developed by the NY State Department of Environmental Conservation's Stream Biomonitoring Unit. Monitoring data for sites in Orange County was collected as part of a county-wide stream biomonitoring project sponsored by the Orange County Water Authority, with funding from the US EPA (these data are provisional). Monitoring work for sites in Rockland County was sponsored by the Rockland County Soil and Water Conservation District. J. Kelly Nolan is the principal investigator for both projects, and they are both administered by Hudson Basin River Watch Inc., a non-profit organization. Based on the analysis of the invertebrate communities from each site, the water quality categories ranged from non-impacted to moderately impacted. The most likely sources of impairment, determined by Impact Source Determination, included non-point source nutrient enrichment, municipal and industrial inputs, toxins, and sewage effluent.

Lotic Scene Investigation (LSI) program for higher education.

J. Kelly Nolan[1], D. Reed[2] and S. Gruber[3]. [1]Watershed Assessment Associates, [2]Hudson Basin River Watch, [3]Orange County Water Authority

Lotic Scene Investigation (LSI) is a research program for college students that promotes conceptual thinking, decision-making, and practical skills in science majors with an interest in

freshwater aquatic science. The LSI program provides students with necessary training in all aspects of rapid watershed assessment, along with the opportunity to partake in an active research program under the guidance of a skilled water quality investigator. The course consists of three modules: lecture, field and lab practice, and residential field station experience.