BLACK ROCK FOREST NEWS

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Research Symposium Highlights Varied Studies

Some 75 scientists, educators, and other interested people gathered in the new Forest Lodge on June 20, 2005, for the Fourth Black Rock Forest Research Symposium. Twenty speakers covered such topics as forest ecology, invasive species, biogeochemistry, forest fragmentation and urbanization, and biodiversity. "Like the three previous symposia, this event offered researchers a good opportunity to meet and talk with fellow scientists working in the Black Rock Forest and surrounding areas," notes Forest Director Dr. William Schuster. "It provides a single forum that summarizes much of the current research underway, giving background for individual studies and in some cases leading to the development of collaborative studies."

Jessie Cherry with equipment for studying snow.

Forest Trends

Dr. Schuster opened the symposium with a presentation on changes in above-ground tree biomass in the Forest over the past 75 years, noting that "total biomass and annual increment in biomass are important measures of ecosystem status, productivity, and health." Using historical data from the Forest's long-term plots established starting in 1930 and from Forest-wide inventories in 1930 and 1985 and partial inventories in more recent years, he applied species-specific allometric equations (equations relating size and shape to mass) to convert this information into biomass estimates.

These calculations showed that forest biomass increased on a per hectare basis between 1930 and 2000, with the most productive period between 1930 and 1960, and the least between the early 1960s and the 1980s (probably due to the severe regional drought in the 1960s and mortality due to the gypsy moth in the 1980s). However, between 1999 and 2004, canopy tree mortality rates of about 3% per year resulted in an overall loss of more than 10% of the live above-ground biomass in the long-term plots; important factors have been drought-induced mortality, insect-mediated mortality (due to hemlock woolly adelgid), and disturbances in the form of fires, ice damage, and windthrow. Similar trends were observed in the Forest-wide inventory data. "Substantial changes in productivity, composition, and other ecosystem characteristics and processes have begun in the forests of the region," Dr. Schuster concluded.

Dr. Neil Pederson, of the Tree-Ring Laboratory at Lamont-Doherty Earth Observatory, also examined

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Consortium Day

Stillman Award to Carol Ash

For the first time this year, Consortium Day festivities were held inside the new Forest Lodge, rather than outside under a tent, and the geothermal cooling system made stepping into the Lodge from the sweltering pre-summer heat like entering the Forest on a crisp autumn day! On June 12, some 150 representatives of Consortium member institutions and other friends of the Forest enjoyed a day of scientific and educational activities, highlighted by tours of the Lodge, explanations of the solar panel project by the architects, and the presentation of the annual E. G. Stillman award to Carol Ash, executive director of the Palisades Interstate Park Commission. The afternoon ended with the usual delicious food and camaraderie.

Fun for All Ages

This year's schedule included some new activities, along with old favorites. The afternoon started with a talk on the trout rearing project (see "Brookies at Black Rock," Spring 2003) by Forest Manager John Brady, followed by their release into Black Rock Brook. Will Bowman, a graduate student at Columbia University, and Executive Director Dr. William Schuster led a walk focusing on tree growth and physiology in relation to age and health; Dr. H. James Simpson of Lamont-Doherty Earth Observatory and his graduate student Josslyn Simpson (see "Precipitation, Stream Chemistry Key to Ecosystem Processes," Winter 2005) conducted water chemistry experiments while discussing the relationship between precipitation and stream water chemistry; and Dr.

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Black Rock Forest Consortium

Black Rock Forest News is published three times a year by the Black Rock Forest Consortium.

The Black Rock Forest Consortium is an alliance of public and private schools, colleges, universities, and scientific and cultural institutions engaged in research, education, and conservation in the 3800-acre Black Rock Forest in New York's Hudson Highlands.

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Black Rock Forest News
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Report from the Executive Director

Mercury in the environment has received much recent attention. Levels of this well-known neurotoxin high enough to be of concern have been reported in fish and in many lakes, especially around the northeastern United States. This may be partly due to improved techniques for detecting mercury, but also to increased levels of mercury availability and uptake by organisms.

Elemental mercury is a minor element in the earth's crust, but its use by humans has greatly increased its abundance in air and waters. Coal-fired power plants are currently the largest human-caused source of mercury emissions to the air in the United States – about 50 tons per year. Approximately half enters the global atmospheric cycle and half is deposited locally. The northeast receives especially high deposition because of proximity to emission sources and prevailing wind patterns.

Atmospheric mercury is deposited to the earth's surface through both wet (rain and snow) and dry deposition. Microorganisms in soils and sediments have been shown to convert some of it into methylmercury, a highly toxic form that is the most common form found in the environment. As a result of runoff to aquatic systems and production in sediments, many lake systems exhibit dangerously high levels. Extensive studies have documented that it is widespread in the northeast but heterogeneous in distribution, including a number of "hot spots" of very high methylmercury availability.

In aquatic systems, methylmercury is transferred up the food chain from plankton to invertebrates and fish, with fish higher in the chain ending up with much greater concentrations. Birds and mammals that eat fish, and predators that eat fish-eating animals, end up exposed to mercury poisoning. At high levels, the effects include reduced reproduction, slower growth and development, abnormal behavior, and even death. The March 2005 issue of *Ecotoxicology*, on environmental mercury in the northeast, documents high levels of methylmercury in some insects, fish such as brook trout, white and yellow perch, northern pike, and walleye, loons, osprey, otters, and mink.

Almost all people have at least trace amounts of mercury in their tissues, but high levels can harm many organs and systems; in unborn babies and young children, they may harm developing nervous systems, impairing thinking and learning. In the United States, people are primarily exposed by eating fish containing methylmercury, leading to fish consumption advisories in most states.

Recent research documents high levels of terrestrial methylmercury, particularly in forested, mountainous environments in the northeast. High levels have been found in leaf litter on the forest floor and in certain types of insects. Most at risk are species that eat these insects; high levels have been found in shrews and some birds. The BioDiversity Research Institute in Maine, which has for years studied mercury in loons, sampled blood from wood thrushes in Black Rock Forest this summer. Regional deposition models also suggest we could have a serious problem.

Controls on mercury emissions from waste incinerators reduced total emissions by 40% between 1990 and 1999. The 2005 Clean Air Mercury Rule is designed to reduce emissions from coal-fired power plants: methods, timetables, and targets are under consideration. However, the elimination of mercury in the air and oceans will take many years, even after all emissions are terminated.

More research is needed to assess the dangers and to understand the dynamics of mercury deposition, methylation, and uptake in forest systems. Mercury monitoring stations are very important, as inputs represent critical variables in any rigorous accounting process. The Mercury Deposition Network (MDN) of the National Acid Deposition Program (http://nadp.sws.uiuc.edu/mdn/) has some 85 sites but, despite models projecting that the area immediately around Black Rock should be among the highest for total mercury deposition, there are none within 70 km, and none in the New York metropolitan area, New Jersey, or Connecticut. We hope to find a sponsor who will support the addition of the Forest to the MDN network to fill this important void.■

— Dr. William Schuster

Consortium Day *(continued from page 1)*
Vladimir Ovtsharenko, a scientist at the American Museum of Natural History, slung a net over his shoulder and conducted an insect collection demonstration (see "Small Grants Highlight Integration of Research and Education," Spring 2005). In the still unfinished basement classroom of the Lodge, John Brady, Operations Manager Jack Caldwell, and a group of enthusiastic children built bluebird boxes and sun catchers, artistic hangers designed to sparkle in the sun Throughout the afternoon, architect Paul Tapogna from Fox and Fowle and Jack Caldwell took visitors on tours of the Lodge.

Over at the Science Center, displays included information about the solar panels, an exhibit on the Willow Avenue Elementary School's (Cornwall) first grade pond ecology project, a demonstration of the School in the Forest's acid rain neutralizing experiment (New York City Public Schools PS/IS 311 and PS 220), descriptions of the Browning School's ninth grade individual science projects, and research project posters by students in the Summer Ecosystem Experiences for Undergraduates program run by the Center for Environmental Research and Conservation at Columbia University.

Program and Presentations

The program in the Forest Lodge began with Sylvia Smith, architect for both buildings and a principal at Fox and Fowle, presenting Dr. Schuster and Consortium Chairman William T. Golden with copies of *Designing for the Built Realm*, a just published and stunningly illustrated monograph of the firm's work that includes several pages highlighting the Black Rock Forest buildings. Her associate Paul Tapogna then described the solar energy project, which involves placing photovoltaic panels on the Science Center roof and on two new structures: a roof over the steps from the parking area and an outdoor teaching pavilion adjacent to the Center. Together, these panels will provide some 34,000 kilowatt-hours per year, offsetting about 50 percent of the Science Center's electricity costs and saving the Consortium an estimated $7000 per year. The system is expected to be in operation this fall (see "New Solar Panels on Science Center," Spring 2005).

Each year, the Consortium presents its E. G. Stillman Award, named after Forest founder Dr. Ernest Stillman, to people who have provided environmental leadership and support for Black Rock Forest and its Hudson Highlands region. At Consortium Day, Dr. Schuster presented the 2005 Stillman Award to Carol Ash, executive director of the Palisades Interstate Park Commission. He praised her leadership, ability to "think big" and stick to her principles, encouragement of open dialogue, energy, vision, sense of humor, and real connection to people. Previously, Ms. Ash has served as the state director for the Nature Conservancy and a regional director of the state Department of Environmental Conservation.■

Carol Ash with the 2005 E. G. Stillman Award (top) and Forest Manager John Brady (seated on log) at release of brook trout into Black Rock Brook (bottom)

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tree biomass trends, focusing on the growth and climatic sensitivity of northern red oak (*Quercus rubra*) at 20 sites across New York State and central New England with varying land-use histories, age classes, and environmental conditions. At Black Rock Forest, he examined oaks from both a high- and a low-productivity site, coring trees and using annual ring width data and allometric equations to estimate average annual carbon increments, at the tree level, through time. For the red oak, average growth rates across the region have increased steadily since 1930, but those at Black Rock Forest are lower than the regional average, especially at the low-productivity site; additionally, and contrary to the regional trend, growth rates in the Forest have declined since the early 1990s. Dr. Pederson also discussed some of the factors influencing growth rates: once site quality is standardized, older trees have higher rates than younger trees, and trends in annual growth rates between 1977 and 2001 tend to be positive for trees in southern parts of the region and negative in northern parts, possibly because of differences in climate changes, with the south becoming wetter and warmer over this period.

Dr. Dorothy Peteet, from the NASA/Goddard Institute for Space Studies and Lamont-Doherty, took a longer view, examining changes in carbon storage in Forest wetlands since deglaciation. She noted that soil is important in the overall carbon budget because some one-half to two-thirds of the carbon in mid-latitude forest ecosystems is in the soil, and that Black Rock Forest pollen stratigraphy is a good example of East coast patterns, showing classic pollen zonation. By analyzing macrofossils and fossil pollen in sediment cores and using carbon-14 dating techniques, she compared 12,400 years of vegetational changes in Sutherland Fen (a fen is a wetland not created by river flooding, with its own specialized plants) with changes in nearby Suth-

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Symposium *(continued from page 3)*
erland Pond and in Glycerine Hollow, which is a riparian wetland. The Sutherland Fen cores show a high rate of carbon accumulation during the late glacial period, when spruce dominated, compared to the Holocene, or post-glacial period, when oak dominates. Vegetation changed as temperature and hydrology varied during the Holocene, and all of these changes have contributed to changes in carbon storage in the Fen, with the accumulation of carbon representing the difference between productivity and decomposition.

"Seeing how carbon accumulation has changed with past climate changes is a great way to look at the future," notes Dr. Peteet, adding that this research barely scratches the surface of carbon sequestration studies. "While many studies are done of modern fluxes of carbon in the modern landscape, our paleocarbon research tells us that hot, dry climate intervals store less carbon in wetlands, which leads to important implications about the future of carbon storage in a hotter climate, specifically predicting less carbon stored in such a future environment."

How Trees Grow

Several researchers discussed the physiology of trees and other plants, concentrating on carbon flux. In an article on related studies in this newsletter, Dr. Kevin Griffin of Lamont-Doherty explained that "our overall aim is to quantify the carbon balance of forest ecosystems and identify the environmental and physiological variables that limit carbon uptake," noting that this work both addresses basic research questions and has significant practical implications (see "Understanding What Controls Tree Growth," Spring 2004).

Will Bowman, a Columbia University graduate student working with Dr. Griffin, used red oaks (*Quercus rubra*) from stands of different ages (30 to 130 years old) in Black Rock Forest to study how tree age affects respiration from woody stems and branches. During respiration, some of the carbon accumulated in a plant through photosynthesis is released back to the atmosphere as carbon dioxide; thus, quantifying it is important for understanding carbon flux in forest ecosystems. By measuring carbon dioxide efflux from the trees, sap velocity, and internal carbon dioxide concentrations in both growing and dormant trees of different ages, he was able to investigate the anatomical and physiological traits that serve as barriers to the diffusion of carbon dioxide into the atmosphere and compare them across stands. He discovered that respiration is strongly related to temperature and that, in summer, older trees had less carbon dioxide efflux to the atmosphere. "These findings," he noted, will help us predict how forest carbon uptake will change as oak stands in Black Rock Forest, and throughout the northeast, age."

Dr. Griffin then focused on a related topic, pointing out that while "a long-held paradigm in forest ecology posits that the growth rate of trees declines with age, very few tests of this idea have been made, particularly in tree species common to the forests of the northeast." Using 60 red oaks (*Q. rubra*) of varying ages (31 to 150 years old), he and his colleagues measured physiological, biochemical, and physical properties at both the leaf and tree levels. They evaluated three hypotheses for a decline of growth with age: unbalanced photosynthesis and respiration, decreased nutrient supply or increased limitations on nutrient uptake, and increased hydraulic resistance.

They found no significant relationships between tree age and any of the measured variables except for canopy volume, tree diameter, and leaf-area index (a measure of total leaf area). Further, tree cores revealed the growth rate remained relatively constant from 30 to 150 years. Thus, they concluded that "age-related decline does not affect this species and that high rates of photosynthesis, constant rates of leaf respiration, and decreasing rates of stem respiration with age (as noted in Will Bowman's presentation) allow this species to remain a vigorously growing component of the ecosystem until it is ultimately replaced through ecological succession."

Chengyuan Xu, another of Dr. Griffin's graduate students, has been studying seasonal photosynthetic variations in three co-occurring understory shrubs to see whether these play a role in the competitive vigor of the invasive Japanese barberry (*Berberis thunbergii*), which leafs out early, compared to two native species: high-bush blueberry (*Vaccinium corymbosum*), a shade plant that leafs out later, and mountain laurel (*Kalmia latifolia*), an evergreen. After measuring photosynthetic capacity in these plants throughout the growing season and examining other factors such as temporal variations in nitrogen allocation and limitations on stomatal conductance (the stomata are pores in leaves that permit gas exchange), he concluded that early spring photosynthetic activity in the barberry contributes to its overall carbon gain and thus its competitive ability against the native species.

Impact of the Woolly Adelgid

Two talks focused on the impact of another invasive species, the hemlock woolly adelgid (*Adelges tsugae*), on northeastern forests (see "Hemlock Adelgid: New Study Looks at Ecosystem Impacts," Fall 2004). An aphid-like insect no bigger than the head of a pin, the hemlock woolly adelgid feeds on the needles of Eastern hemlocks (*Tsuga canadensis*); as an exotic (non-native) species, it has no native predators and hemlocks have never evolved defenses against it.

Between 1999 and 2004, Dr. J. D. Lewis, of Fordham University, examined hemlock defoliation and mortality in plots dominated by hemlocks and in plots with a mixture of hemlocks and hardwoods to examine variations from year to year and the role of hemlock density. He found that 65% of the hemlocks in hemlock-dominated stands died (averaging about 20% per year), compared to 51% in mixed stands (about 15% per year), although in one year (2000-2001) there was essentially no mortality. While noting grimly that 60% of the hemlocks he measured in 1999 are now dead, Dr. Lewis also pointed out that some 5 to 10% of the trees show signs of resistance: although they were partially defoliated by the adelgid in the early years of the study, they have since replaced some of their lost foliage.

Dr. Abby Sirulnk, a postdoctoral researcher working with Dr. Lewis, is investigating the potential impacts of the hemlock woolly adelgid below ground. Hemlocks host ectomycorrhizae, fungal symbionts growing between root cells that help the trees

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acquire nutrients, tolerate drought, and resist pathogens. She studied the effects of adelgid infestation on ectomycorrhizal communities (abundance and species richness) and on forest soil conditions (soil nitrate, pH, and water content) in three different watersheds and in forest stands dominated by relatively healthy hemlocks, adelgid-infested hemlocks, and oaks (which are also mycorrhizal).

Stands infested with the woolly adelgid had fewer ectomycorrhizal root tips, lower ectomycorrhizal species richness, higher soil nitrates, and higher water content. Oak-dominated stands had the highest number of ectomycorrhizal root tips and species richness. These results suggest that effects of adelgid infestation can occur underground and that nitrogen cycling and soil moisture may be affected by hemlock decline.

Forest Fragmentation

Increasing urbanization affects the ecosystem in many ways, including habitat loss as land is cleared, which leads to fragmentation, and road development, which not only may limit movement of some species but also creates an edge effect that increases heat, light, wind, soil compaction, and other factors. Hiking trails and roads in Black Rock Forest, while smaller than highways, may also create edge effects, and two researchers, Jean Rothe, a former Columbia graduate student now at Quinnipiac University, and Dr. James Danoff-Burg, of the Center for Environmental Research and Conservation at Columbia, discussed their impact on, respectively, birds and beetles.

The bird study, conducted in cooperation with the New York-New Jersey Trail Conference, focused on species that breed in the Forest, rather than early migrating species that pass through on their way north. From May to July in 2003 and 2004, from 5:30 to 10 AM, Jean Rothe and her colleagues looked and listened for birds at six trailside sites, six roadside sites, and six sites in the Forest interior, making 999 observations in 2003 and 1186 in 2004; they also gathered trail use data. They found no variation in average bird diversity and abundance among the different types of sites and no correlation between human trail use and bird diversity and abundance. They attribute this minimal impact to consistent canopy cover, but suggest that further studies could assess more subtle effects such as nesting success, nesting site preferences, and long-term changes in species composition.

Dr. Danoff-Burg pointed out that decomposer, or necrophage, beetles provide a variety of ecological services, including disposing of and decomposing vertebrate carrion, enhancing soil fertility, and potentially reducing vertebrate gastrointestinal parasites. In contrast to their minimal effect on avian diversity, forest roads do affect these beetles, which are particularly sensitive to the abiotic changes that come with edge effects.

He found that all the species he studied significantly avoided all roads, ranging from a four-lane divided highway down to even little-used woods roads, decreasing decomposer beetle diversity at the individual, population, and community levels. Less vagile species were affected more than those that move more freely. Decreased beetle abundance and diversity can lead to increased fly abundance, which may have significant human health consequences. However, in contrast to roads, trails do not seem to have any clear impact on the necrophages. "It seems," he noted, "that the little-used hiking trails have minimal impacts on beetles, as well as on birds."

Liz Nichols, from the Center for Biodiversity and Conservation at the American Museum of Natural History, discussed research she conducted while a graduate student at Columbia, working with Dr. Danoff-Burg, on the relative abundance of dung beetles and dung-breeding flies on an urban-to-rural gradient (see "Student Research Spotlight: Urbanization and Protected Areas," Spring 2005). She looked at contiguous forest and at forest fragments surrounded by matrices of forested, agricultural, suburban, or urban land, and found that increasing urbanization reduced both the numbers of beetles and the number of beetle species, while increasing both the numbers and species of flies. As decomposers, dung beetles provide important ecological services, including nutrient cycling, waste removal, soil conditioning, suppression of vertebrate parasites, and secondary seed dispersal; the presence of dung-breeding flies may prevent the beetles from carrying out the activities that provide these benefits.

"Collectively," Dr. Danoff-Burg sums up, "these three research projects seem to indicate that the road building and habitat fragmentation that invariably occur with increasing urbanization may have more far-reaching and profound impacts upon the environment than might initially be expected. Black Rock Forest, with its extensive forested areas, may serve as a model for conservation by helping to retain the biodiversity that will be lost with urbanization of the surrounding areas."

Biogeochemistry

Josslyn Shapiro, a graduate student in Earth and Environmental Sciences at Columbia who is working with Dr. H. James Simpson of Lamont-Doherty, discussed her research on chloride and acidity in precipitation and surface waters in the Forest (see "Precipitation, Stream Chemistry Key to Ecosystem Processes," Winter 2005). As Dr. Simpson explained in that earlier article, "the biota and soils of Black Rock Forest represent a balance among continually changing, difficult to quantify processes that are critical to the long-term health of the ecosystem," and gathering empirical chemical data can "provide fundamental information on many process of broad interest."

Ms. Shapiro's analysis suggests that chloride deposition via precipitation is greater than would be predicted assuming only a marine origin for chloride (from sea-salt aerosols), thus indicating a significant amount of "excess" chloride in precipitation. This "excess chloride" is consistent with regional processes known to produce hydrochloric acid, such as emissions from coal-fired power plants, domestic and industrial waste incineration, and the interaction of acidic gases and sea-salt aerosols in the atmosphere. Ms. Shapiro has also documented seasonal and decadal trends in acidic precipitation (i.e., sulfate and nitrates), which are of some local interest since acid rain can have important negative impacts on terrestrial and aquatic ecosystems. She noted that hydrogen ion deposi-

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Symposium *(continued from page 5)*
tion decreased by 38% from 1981 to 2003, a trend consistent with regional reductions in emissions of sulfur dioxide and nitrogen oxides.

Biodiversity

Several talks focused on specific groups of animals in Black Rock Forest. Dr. Vladimir Ovtsharenko, from the American Museum of Natural History, discussed his ongoing project to collect and identify the spiders and insects of the Forest (see "Small Grants Highlight Integration of Research and Education," Spring 2005); so far, he has found some 300 species of spiders and estimates there are thousands of insect species. His work has educational and outreach components in addition to the research; he has disseminated the spider findings on the Museum's web site at http://research.amnh.org/entomology/blackrock with a photo gallery, a species list, information on spider distribution within the Forest, and an identification key.

Sean Giery, a research assistant at the Institute of Ecosystem Studies, presented information showing that, while three common species of eastern lizards carry the bacterium that causes Lyme disease, two of them do not transmit it to the ticks that feed on them and can thus serve a protective role. Randy Stechert, a consultant to the New York State Department of Environmental Conservation discussed conservation of timber rattlesnakes (*Crotalus horiddus*), a threatened species in the state.

Technology

Two speakers described the use of technology to advance environmental efforts. At the molecular level, Julie Feinstein, the Collection Manager for the Ambrose-Monell Cryo Collection (AMCC) at the American Museum of Natural History, explained that its mission is to "provide digital access to biodiversity information, especially for genetic materials used in taxonomic studies . . . and to meet the demand for properly documented frozen tissue specimens used for genetic analysis." So far, some 40,000 specimens have been stored in vials labeled with bar codes and frozen at approximately -160°C in vats cooled by liquid nitrogen. Specimen data are recorded in a relational database that identifies their location as well as providing collection, genetic, and other data.

The goal of the Black Rock Forest collecting project is to create a "biological snapshot" of 2005, with Museum scientists accompanying teams of students and staff to collect selected faunal groups (including butterflies, aquatic invertebrates, amphibians, birds, bats, and small mammals) and identify specimens; the tissues will be archived in the AMCC. Ms. Feinstein stressed that all tissue samples are available to the scientific community for genetic analysis, and extended an offer of "free collection support and archiving services to all researchers conducting animal studies in Black Rock Forest."

At the other end of the size spectrum, Dr. John Mickelson, of the Center for Earth Science Information Network (CIESIN) at Columbia University, is investigating ways to improve "our ability to resolve, map, and analyze more accurate and precise digital geospatial data and information systems representing land cover and ecological communities." He and his colleagues use satellite imagery (Landsat), other digital geospatial data, and GPS-referenced ground plots to evaluate the changes in the spectral and spatial signals that ecological communities exhibit over the growing season. He noted that improved resolution of land-cover classes, using this ecological approach, will facilitate effective mapping, monitoring, and modeling of environmental patterns and processes across spatial and temporal scales, and that he and his colleagues are now attempting to use this approach to include patterns of such invasive species as purple loosestrife (*Lythrum salicaria*) and the common reed (*Phragmites australis*).

Earth History and Climate

Dr. Dallas Abbott, of Lamont-Doherty, presented a study of the Burckle crater, a crater in the central Indian Ocean created by a meteor that hit the earth some 6000 years ago. She and her colleagues believe that the meteor may have broken up and thus that there are probably other sites of large impact, including one in the northern hemisphere. Since the impact of the meteor produced layers of minerals with clearly defined characteristics, she and her colleagues are looking for these layers in a soil core from a marsh in Black Rock Forest.

Dr. Bruno Tremblay, also of Lamont-Doherty, presented data from the SHEBA program (Surface Heat Budget of the Arctic Ocean). He and his colleagues are seeking to understand "how interactions between atmosphere, ocean, sea ice, and snow cover in the Arctic affect climate." Specifically, they are looking at heat transfer from the base of the snowpack (which is warmer, because it is closer to the ocean) to the surface (which is colder, because it is closer to the atmosphere) through snow, including transport of heat through conduction, water vapor migration (called latent heat transport), and air movement (called wind pumping). They will use data from Black Rock, including measurements of snow density versus depth, along with previously recorded atmospheric variables, to study these processes.

Jessie Cherry, a graduate student working with Dr. Tremblay, gave a talk on what can be learned from snow research at Black Rock Forest. She proposed the creation of a dual-use snow research station that could be used at the Forest in the winter and in the Arctic in the summer, noting that monitoring and modeling snow at the Forest could be useful for local water resource planning, while observation and monitoring in the Arctic is "important for investigating basic snow physics, as well as snow-related change and variability in this climate-sensitive region."

Posters

Ten research posters were on display in the Center for Science and Education, covering such topics as biodiversity, environmental education, the impact of the hemlock woolly adelgid, plant physiology, pond and bog pollen profiles over the past 12,000 years, stored soil carbon, and the use of macroinvertebrates to analyze water quality. Abstracts of the poster presentations, as well as of all the scientific talks, are available on the web at www.blackrockforest.org/research/Symposium2005.pdf.■

Editor's Note

The list of research projects that usually appears on this page is not included in this issue because the studies are discussed in this article on the Research Symposium.■

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Forest News in Brief

Metropolitan Montessori School Joins Consortium. The Metropolitan Montessori School, a K-6 school on Manhattan's Upper West Side with a strong focus on environmental stewardship, was accepted as a Consortium member last May, has already used the Forest Lodge twice, and has enthusiastically scheduled Forest visits every Tuesday throughout the academic year. "Putting children in touch with nature and how it works, creating wonder/understanding/gratitude, and calling for transcendent individual responsibility are what we routinely seek to do in our classrooms," says Assistant Head Bob Reveri. "With our membership in the Consortium, we now have the ability to more intensely work on these goals with both students and staff in a new, magnificent, abundant environment."

Lodge Can Serve Many Needs. Are you planning a faculty meeting, art or literary class, or department retreat? While the Lodge was designed for student groups and researchers, it is also ideal for many other activities. For example, the School at Columbia held a retreat for its entire faculty and administration at the Forest during the last week of August, and the New York-New Jersey Trail Conference is holding its annual meeting at the Forest in October. More information about the Lodge is available at www.blackrockforest.org/consortium/lodge/index.html or by calling Operations Manager Jack Caldwell in the Forest office at (845) 534-4517.

Workshop on Forest Management. On September 9, Black Rock Forest hosted a workshop called "Caring for Wildlife and Forests: What Every Landowner Should Know" that was cosponsored by Audubon New York, Cornell University, Cornell Cooperative Extension, the Hudson Highlands Landowner Assistance Program, and the Watershed Agricultural Council, along with the Consortium. Kristi Sullivan from Cornell University discussed an Audubon New York study that examined the abundance and diversity of birds and amphibians in mature forests and forests after light (30%) and heavy (70%) timber operations: while the response varied substantially among species, the highest overall diversity tended to be in lightly cut forests. Matthew Paul said that the Watershed Agricultural Council can help landowners with at least 5 acres of forest create forest management plans.

Forest Highlighted in Green Building Events. The Center for Science and Education and Forest Lodge will once again be featured in the Northeast Sustainable Energy Association's (NESEA) Green Building Open House, to be held on October 1 (visit www.nesea.org for more information). The Science Center was one of NESEA's 2004 Green Building Award winners. Also, Executive Director Dr. William Schuster will discuss the Forest's buildings at an October 26 conference at the Newburgh Free Library, "Green Buildings, Landscapes and Communities: Linking Sustainability, Affordability, and Economic Vitality," cosponsored by the Orange County Planning Department, New York State Energy Research and Development Authority, and others. The organizer, Simon Gruber, can provide more information about this event.■

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Reserve Lodge Space Now!
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Report from the Forest Manager

"Heading out from the John Odell place, over the island toward the coon den, bark house, and queer spring brook." This is how Arthur Babcock, Black Rock's first Forest Manager, would have described the trail now named after him – the Arthur Trail – 100 years ago. Today, we describe the same path as the trail from Split Rock at Sutherland Pond to Eagle Cliff. Centuries ago or today, the obstacles are the same: the outlet of Sutherland Pond (Mineral Spring Brook) and subsequent swamp have always been precarious for travelers.

The outlet stream channel, about 12 feet across, has usually been crossed by a well-placed oak log. The long swamp crossing has been dealt with in many different ways. The earliest known techniques for crossing the swamp were created by Victor Martineck, known as the Forest hermit (see "Hermit of Black Rock," Winter 2004).

Victor was the only person given written permission to occasionally reside in Black Rock Forest. In exchange, he cared for the trails in the Forest he loved so deeply. His answer to the difficult mucky swamp crossing was a corduroy walkway made of sticks. He called it Spaghetti Bridge and would leave a supply of walking sticks at each end to aid its users. As Victor's time came and went, the Spaghetti Bridge dissolved into the swamp. The only way to traverse the swamp then was to hop from clump to clump of grass (hummocks), often slipping into the muck.

In the mid-1980s, attention was given to the crossing. Wood disks (or "cookies") were cut from a nearby dead white oak tree and placed across the swamp. This part of the path then came to be called "the Cookie Trail" and became a favorite of elementary school classes.

After 15 years, the "cookies" were being "eaten" by the swamp and were too moss-covered to give solid footing to hikers. To our great surprise, these white oak "cookies" had attracted a healthy colony of the carnivorous plant sundew.

These rare plants excrete a sticky fluid from their leaves, in which insects become entangled. The leaf closes around the entrapped insect, and excretes another fluid that digests the insect. This unusual plant was once thought to cure old age, but has proven more useful in treating symptoms of asthma and bronchitis.

To preserve the sundew and create an improved walkway, a Forest crew led by Matt Brady and Brendan Murphy undertook the construction of an elevated boardwalk. Using the trees of Black Rock Forest, Matt and Brendan milled appropriate species to build a 120-foot causeway. They selected the rot-resistant black locust trees for piers into the mucky swamp, and white and chestnut oaks as planking to ensure the longevity of the boardwalk.

Then a crew consisting of Matt Munson, Brad Munson, Joe Oliva, Ben Brady, and Whitney Schuster suffered through extreme humidity, bugs, and muck — and even tracks that looked like those of a black bear — to carry in materials, clear trails, and construct their legacy of the summer: a new walkway through the Sutherland swamp.■

— John Brady