BLACK ROCK FOREST NEWS

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Precipitation, Stream Chemistry Key to Ecosystem Processes

Hidden in the clear water running through Black Rock Forest's many streams, its peaceful ponds, and the rain and snow that fall on it are some of the keys to understanding the dynamic balance of many ecosystem processes. For several years, Dr. H. James Simpson from Lamont-Doherty Earth Observatory, along with colleagues and students, has been studying the biogeochemistry of the Cascade Brook watershed. Now, Josslyn Shapiro, a graduate student in Earth and Environmental Sciences at Columbia, is examining precipitation chemistry and regional monitoring data and analyzing the chemical composition of current and archived water samples from Cascade Brook.

Josslyn Shapiro at NADP precipitation station.

The atmosphere contains water vapor, cloud droplets, raindrops, and a large variety of gases and tiny particles, some released by natural processes such as marine storms that produce air bubbles that burst and inject sea salt into the atmosphere, and others produced by human activities such as driving cars and burning coal to generate electricity. When the water vapor in the air condenses and then falls as precipitation, whether rain or snow, it includes many of these chemicals, which thus reach the surface of the earth. In a forest like Black Rock, they find their way into the soil, plants, and animals, and into the ponds and streams that transport them out of the Forest.

Ecosystem Chemistry

"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," explains Dr. Simpson. "Empirical data on the chemistry of precipitation and surface waters can thus provide fundamental information on many processes of broad interest, such as accumulation of nitrogen and carbon in soils and living organisms, that cannot be measured accurately by direct approaches. However, they can be approximated by careful accounting of the inflows and outflows of dissolved chemicals in precipitation and streams. This indirect approach may be one of the most effective ways to understand how forest biota behave over years to decades."

Interpretations of global phenomena rest on long-term monitoring and painstaking, detailed analysis of environmental data from specific sites. So Ms. Shapiro is analyzing the concentrations of dissolved chemical species from the atmosphere that come into the Cascade Brook water-

(continued on page 4)

Tree Physiology Studies

Students Conduct Field Research

Separately and together, university students and high school students investigated tree physiology in Black Rock Forest on October 22 and 23, with most staying overnight in the new Forest Lodge. Dr. Kevin Griffin of Lamont-Doherty Earth Observatory brought six students, both undergraduate and graduate, along with a teaching assistant, as part of his Columbia University course in plant physiological ecology. At the same time, eighteen juniors and seniors from Friends Seminary, accompanied by environmental studies teacher Antonia Daly and biology teacher Margaux D'Auteuil, visited the Forest to study carbon sequestration in various tree species. Their paths crossed when some of the high school students volunteered to assist Dr. Griffin and his group.

Investigating Oaks

The Columbia students primarily gathered data for three class projects investigating the physiology of red oaks (*Quercus rubra*). An important piece of information for these studies is tree weight, Dr. Griffin notes, but since it usually undesirable to cut down trees, researchers generally use allometric equations (equations relating size and shape) to estimate the mass of a tree from its diameter. These equations, which differ for different species, have been published, but must generally be checked and refined for specific sites. "Bill Schuster and John Brady have been working on this for years, often with the help of Peter Bower's Barnard College environmental science students," Dr. Griffin says.

(continued on page 5)

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 3785-acre Black Rock Forest in New York's Hudson Highlands.

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Brooklyn Botanic Garden
Browning School
The Calhoun School
Columbia University
Cornwall Central School District
The Dalton School
Friends Seminary
Marine Biological Laboratory at Woods Hole—The Ecosystems Center
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Black Rock Forest News
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Report from the Executive Director

This issue highlights some current studies of chemical cycles in the Black Rock Forest (see p. 1). Monitoring chemical reservoirs and fluxes is important because they can indicate ecosystem function and health. One chemical of interest is chlorine, an essential element for life that generally occurs as the negatively charged chloride ion.

A recent conference convened by the Hudson River Environmental Society (www.hres.org) highlighted how chloride levels and fluxes can indicate important changes in ecosystem processes and health. Excess chloride entering small lakes can produce a heavy layer of salty water at the bottom. This can prevent the natural biannual turnover of the water column that replenishes nutrients. High salt levels inhibit the growth of many plants, particularly evergreens, and make it more difficult to obtain water from soils. At high enough levels, chloride can kill organisms; as a result, Canada classifies and handles road salt as a toxic substance.

The acute chloride toxicity standard in fresh water is 860 milligrams per liter (mg/l), but some organisms are killed by chronic levels as low as 150 mg/l. Benthic organisms, at the base of aquatic food webs, are especially susceptible. The EPA's recommended maximum concentration for drinking water is 250 mg/l.

Data from around the Hudson River Basin clearly demonstrate that freshwater chloride concentrations have been rising steadily and steeply, especially since around 1940, a trend that continues today. In the early 1900s, streams in all but the coastal portions of New York State contained less than 1 mg/l chloride. Black Rock Forest streams still run around 1 mg/l chloride, but many others in our region are at 30 mg/l, some as high as 200 mg/l or more. These rising chloride levels are highly correlated with the relative degree of watershed urbanization.

The causes are many. Road salt is heavily and sometimes injudiciously used, wasting money and resources; its use continues to increase. Improper salt storage has led to massive dissolution and entry into soils and streams in the past. But other sources are important, some more so than road salt. Wastewater discharges result in substantial chloride input to surface waters, a situation that is worsening as sewage plants and septic fields deteriorate. Millions of tons of salt are used for chemical processing and for producing food and consumer products. Some 140 million tons are mined each year, with the majority returning through wastes into our waters.

Impacts can be surmised from the recent state Department of Environmental Conservation's 30-year report on water quality of Hudson River tributaries based on macroinvertebrate data. Tributaries with increasing chloride levels have demonstrated consistent declines in benthic species richness, with Woodbury Creek, just west of the Black Rock Forest, one of the prime examples. The report notes that biotic declines have been significantly associated with aging wastewater treatment plants. In numerous streams and ponds near highways, chloride levels are consistently high enough to impact stream organisms.

The majority of samples from fresh waters still exhibit chloride levels below EPA limits and critical thresholds. But the numbers have increased around the region and one wonders if there is enough monitoring to really know where the most important problems are. In some cases, aquifers have become brackish and will continue to emit salt for decades. Reversing this trend in chloride levels will not be easily accomplished, but the conference proposed some solutions and research will hopefully increase toward that end.

We monitor chemical cycles both to better understand ecosystem dynamics and to look for imbalances: too much or too little of almost anything can be detrimental. If not for the existing monitoring programs, we would not even know about the chloride level increases, and other chemicals leaking in our wastewaters may be of even greater importance. Monitoring chemical cycles is similar to watching our own inputs and outputs for parameters such as weight, blood pressure, and cholesterol: an important responsibility in ensuring a long, healthy life.■

— Dr. William Schuster

Training Teachers to Use the Forest

For 38 teachers from seven schools in the Newburgh Enlarged City School District, November 2 was not only Election Day but also a day of training and exploration in Black Rock Forest. The district requires teachers to go through both safety and curriculum training, both outdoors and in the Center for Science and Education, before they can bring students to the Forest, explains Al Romano, the district's science director, who led the group. "The day enabled me to train a large group of teachers and thus created the immediate opportunity for many students to visit the Forest."

Teachers who attended the staff development program teach Regents earth science, Regents and honors chemistry, middle school and elementary science, the living environment, and outdoor education. The Forest's staff provided three sessions in the morning and two in the afternoon.

Topics included geology (rock types, glacial features, topography, soil profiles, soil permeability, and weathering and erosion), chemistry (acid rain and its effects on plant and animal growth), biology (the diversity of plants and animals, and how they interact), and using GPS technology.

Forest Manager John Brady with Newburgh teachers.

"Black Rock Forest enhances our students' learning by giving them a hands-on experience that cannot otherwise be brought into the classroom," Mr. Romano says. "We wanted to enable teachers to integrate this natural environment into their curriculum and to become excited about taking their students into the Forest."

"All teachers should familiarize themselves with the Forest and with procedures for using it," notes Executive Director Dr. William Schuster, "and should explore field activities in advance of their class visits to ensure safe and effective incorporation of field trips into their teaching. The Consortium encourages each member institution to designate a liaison to the Forest who can schedule trips and make arrangements for teacher exploration and training sessions."■

New Science, Education Teams Help Forest Programs Grow

Following up on last March's strategic planning meeting (see "Planning for the Future," Spring 2004), the Black Rock Forest Consortium has begun to create collaborative teams of scientists and educators to help it meet its goals of making the Forest a major site for multidisciplinary ecological and environmental research, a model for integrating scientific research and education, and a learning environment that enables students to understand, appreciate, respect, enjoy, and act as advocates for the environment, while achieving fiscal self-sufficiency. Overseen and coordinated by Executive Director Dr. William Schuster, the teams will work closely with Forest staff to develop and carry out plans to bring Black Rock Forest to the forefront of the national conversation on environment and ecology.

The first team in place is the Science Advisory Group, consisting of five established scientists active in environmental and ecological research: Dr. Kevin Griffin from Lamont-Doherty Earth Observatory; Dr. Don Melnick from the Center for Environmental Research and Conservation and Columbia's Department of Ecology, Evolution, and Environmental Biology; Dr. Jerry Melillo from the Ecosystems Center of the Marine Biological Laboratory at Woods Hole; Dr. Shahid Naeem, also at Columbia; and Dr. Martin Stute from Barnard College. They will work with Dr. Schuster and other Forest staff to create new externally funded research initiatives, lead efforts to produce sharable, scalable, high-quality data, and develop plans to expand Black Rock's research infrastructure and instrumentation.

Next comes the Educational Planning team, with several members already chosen, including Luyen Chou from The School at Columbia (independent schools), Joyce Baron from the School in the Forest program (public schools), Dr. Stephanie Pfirman of Barnard (undergraduate education), and Dr. Angela Calabrese-Barton from Teachers College (teacher training). Other team members will be named soon. Along with Dr. Schuster and Consortium president Dr. Frank Moretti, they will work with Forest staff developing plans for high-quality education programs for K-12 and undergraduate students, teachers, and researchers in training that maximize the use of the natural, scientific, technological, and cultural resources of the Forest and of the Consortium and its members.

"These new teams will bring together many outstanding and dedicated individuals from Consortium member institutions who are already involved in the Black Rock Forest," explains Dr. Schuster. "Having them interact and develop ideas together will be exciting and should lead to innovative research and education programs with long-term impact."

Plans are also in the works for an Information Technology Team and an Operations Team, consisting of both representatives from Consortium member institutions and Forest staff. A Strategic Planning and Development Team will develop plans for the overall programmatic and fiscal success of the Consortium.■

Student Research Spotlight: Analyzing Turtle Census Data

by Amy Lee

For the past eight years, students have worked with American Museum of Natural History (AMNH) researchers and educators on a census of the *Chrysemys picta* (eastern painted turtle) population in Black Rock Forest's seven ponds. The goal is to obtain demographic data for every individual turtle, using a multi-year mark-recapture process [*Ed. Note:* See "Research Symposium," Fall 2003]. Protecting habitats and their resident populations depends on knowing the numbers, types, and status of the individuals making up the communities.

When turtles are initially captured, they are injected with a passive integrated transponder (PIT) tag, a microchip the size of a grain of rice that provides permanent individual identification. Their PIT tag numbers, sex and age, shell measurements, capture method and location, and other information are recorded. The same information is recorded for recaptured turtles.

My part of the project focused on the recatchability of the turtle population, or the frequency with which individuals are recaught after initial capture and processing. I sorted, analyzed, and examined recorded field data for patterns in the turtles' behavior. Studying recatchability allows researchers to monitor a population over a long enough period to evaluate its status (e.g., stable, increasing, decreasing) and to understand how turtles react to the environment and human activity.

Of the 276 adult turtles (118 males, 157 females, 1 unidentified) that have been tagged, 138 have been recaptured. Females were more likely to be recaptured (53%) than males (46%). Recapture rates vary among the ponds from 8% to 61%, and by original capture method: hoop traps, 47%; basking traps, 53%; and active capture methods, 72%.

More than three-quarters of the recaptured turtles were recaptured three times or less, with the rest recaptured four to twelve times, except for one female that has been recaptured 26 times. Turtles recaptured three times or less were mostly female; those recaptured five times or more were mostly male.

Data analysis can correct misconceptions based on observation alone. What was thought to be one turtle, called "Stumpy" since 1996 because of an amputated rear left foot, turns out to be an amalgam of several turtles, missing different feet!

While field work is an important aspect of this census, data analysis is just as crucial: it is what translates this project into tangible results.■

Amy Lee, a senior at Brooklyn Technical High School, has been working with Dave Karrmann, the leader of the AMNH turtle project, since January 2004. She presented her work at the 2004 Northeast Natural History Conference in Albany and has used it for 2005 INTEL and New York City Science & Engineering Fair submissions.

Rain, Streams *(continued from page 1)* shed with rain and snow, and those that leave it in the stream. She is especially interested in ions such as nitrate and sulfate that derive from the acids implicated in acid rain. These acids are created in the atmosphere from anthropogenic gases, nitrogen oxides and sulfur dioxide released by power plants, in vehicle emissions, and through other human activities. She is also interested in chloride, a critical tracer in the hydrologic cycle because it doesn't generally get removed from solution by biological or chemical processes. In contrast, nitrate is taken up rapidly by forest biota as a nutrient for synthesizing amino acids and many other compounds essential to life.

Precipitation

Ms. Shapiro first analyzed seasonal and annual trends in chloride concentrations in precipitation. Here her research relied on the more than 20-year record accumulated at the National Atmospheric Deposition Program (NADP) site located just south of Black Rock on the West Point military reservation, currently operated by the Consortium. Established in 1977, NADP oversees the long-term sampling, measurement, and analysis of chemicals in precipitation at more than 200 locations across the country. The NADP data serve as a proxy for precipitation chemistry in the adjacent Black Rock Forest. Ms. Shapiro compared these local data with information from other regional NADP sites, identified geographical, seasonal, and long-term patterns in chloride wet deposition (both concentrations and amounts), and explored factors influencing these patterns.

She next examined seasonal and long-term trends in acidic deposition, using the NADP data to quantify concentrations and amounts of sulfate, nitrate, ammonium, and hydrogen ion, as well as pH, and is in the process of analyzing these data. She will compare her results both with trends in other forested ecosystems in the region and with emissions of sulfur dioxide, nitrogen oxides, and ammonia at the regional, state, and county level. She notes that many studies have shown that deposition of anthropogenic acids in the northeast has led to soil and lake acidification, leaf and needle discoloration, tree dieback, and excessive leaching of nutrients from the soil. "Quantifying seasonal and long-term trends is an important first step in analyzing the effects of acid precipitation on local ecosystems," explains Ms. Shapiro, who is also collaborating with Dr. Kevin Griffin of Lamont-Doherty and the Forest's Dr. William Schuster.

Streams

Next, Ms. Shapiro will examine outflows of dissolved chemical species from the Forest, using current and archived stream water samples from the Cascade Brook stream monitoring station. She will analyze the chemical composition of these samples to quantify seasonal and long-term trends in chemical concentrations. "We are fairly confident we can quantify trends in chloride output," she notes, "which will allow us, along with calculations of evapotranspiration [loss of water from plant leaves into the air], to calculate the amount of dry deposition of chloride, and thus the Forest's overall chloride budget."

(continued on page 5)

Field Research *(continued from page 1)*

This year, the students measured the diameter of two oaks, one approximately 30 years old and one approximately 100 years old, and estimated their heights. John Brady then felled the two trees, the students measured their actual heights, and data collection began.

For one project, investigating wood respiration over the height of the tree, students collected wood cores and coarse and fine roots and used an oxygen electrode in the lab at the Center for Science and Education to measure respiration in both the inner bark and the sapwood. Another group of students is examining the variation of nitrogen concentration in the wood with height, using the same wood cores: measuring them for volume, drying them to obtain the dry mass, and ultimately grinding them into a fine powder to obtain data on carbon, nitrogen, and hydrogen concentrations.

The third oak project involved cutting "cookies" every two meters along the trunk to quantify the total amount of sapwood. These samples will be dried in Dr. Griffin's lab, and the fresh-to-dry weight conversion will be integrated into the allometric equations. The students will also look at the variation in ring width and sapwood area with height.

A fourth project explores whether the invasive Japanese barberry's early growth start – it leafs out about a month before other plants – is related to spring temperatures.

"The students really enjoyed the trip and thought the Forest was great," notes Dr. Griffin. "The long-term climate and growth rate records, the expertise of the staff, the ongoing research projects, the location, and the spectacular new Forest Lodge all made it a perfect place to give my class hands-on research experience."

Benefits of Field Work

Field work was also a high spot of the Friends Seminary visit, designed to build on classroom lessons on the carbon cycle that included reading Dr. Schuster's 1999 article in *Earth Matters* on changes in tree biomass and carbon content in the Forest from 1930 on. Divided into four teams, the students measured off plots of one-tenth of an acre and identified and measured the diameter at breast height of all the trees in their plots. Using the same kind of allometric equations that Dr. Griffin and his students work with, obtained from a reference book in the Forest's library, the students calculated the dry weight of each tree. They converted that biomass figure first to carbon content and then to the amount of carbon dioxide that the tree sequestered – that is, removed from the atmosphere – to produce that carbon.

Data/Network Manager Matt Munson, Friends Seminary teacher Margaux D'Auteuil, and students.

"As a math teacher, I'm enthused about relating environmental issues to mathematical exercises in a real world situation," explains Ms. Daly. "The students initially registered confusion over the way the equations and units differed by species, but after working with the numbers they came to appreciate how they could quantify carbon dioxide, which they had thought of as just an invisible gas before the field experiment." She notes that this project has many possible extensions: comparing sequestration in different species, calculating the dollar value of the carbon storage function, and relating amounts of carbon dioxide emissions to tree capacities for storing carbon.

Several Friends students also helped with Dr. Griffin's project, binding and carrying tree parts to the scale, recording data, and carrying the wood away. "They were amazed that this much physical labor was involved in scientific research," notes Ms. Daly. The Friends Seminary students also observed that hands-on field work is rewarding and a good alternative to classroom learning, that sampling the trees made the subject more real and understandable, and that team work and cooperation were essential. They also became more aware that their everyday activities can affect the environment and that a science career can be an enjoyable option.

"These kinds of interactions between students and researchers and between visitors from different institutions typify the distinct advantages of having a consortium of institutions jointly operate our field station," points out Dr. Schuster. "The new Forest Lodge, with its capacity to house multiple visiting groups, gives us opportunities to enable more social and academic interactions among visitors than was possible before – and everyone can benefit."■

Rain, Streams *(continued from page 4)*

"Dry deposition" refers to an array of chemical inputs produced by complicated interactions of gases and aerosols with vegetation surfaces. "These inputs can be comparable in magnitude to inputs from rain and snow, but are very hard to measure directly," explains Dr. Simpson. "However, we can estimate dry deposition by difference for chemical species like chloride that are not retained in the forest biota or soils."

Another goal is analysis of stream water for nitrogen species concentrations. Together with information from the precipitation samples, this would provide an important step in measuring how much nitrogen is retained in the Forest, which can help establish links between nitrogen and carbon storage. "Quantifying how forest biota and soils – especially in temperate zone forests of the northern hemisphere – provide long-term storage of carbon released into the atmosphere as carbon dioxide by the combustion of fossil fuels is a subject of global interest," Dr. Simpson notes, "since the fraction of carbon dioxide produced in this way that remains in the atmosphere contributes directly to global warming."■

Current Research at the Forest

The Black Rock Forest Consortium is committed to encouraging collaboration among member institutions and also between researchers and students. To help members learn what other members are doing and explore opportunities for collaboration, we here present a list of current research projects at the Forest, along with contact information. ■

Effects of Hiking Trails on Arthropod and Bird Community Diversity. Ed McGowan (New York-New Jersey Trail Conference) and James Danoff-Burg (Center for Environmental Research and Conservation at Columbia University). *Contact: James Danoff-Burg.*

Controls on Carbon and Nitrogen Cycling in the Cascade Brook Watershed of Black Rock Forest. Kevin Griffin (Lamont-Doherty Earth Observatory). *Contact: Kevin Griffin.*

Long-Term Carbon Storage in Wetlands. Dorothy Peteet (Lamont-Doherty Earth Observatory of Columbia University) and Terryanne Maenza-Gmelch (New York University). *Contact: Dorothy Peteet.*

Effects of Host Defoliation and Distribution on Spatial Patterns in Ectomycorhhizal Fungi. J.D. Lewis (Fordham University). *Contact: J.D. Lewis.*

Long-Term Study (75 Years) of Tree Population Dynamics and Carbon Storage. William Schuster (Black Rock Forest). *Contact: William Schuster.*

Response to Canopy Disturbance in the Black Rock Forest. William Schuster and John Brady (Black Rock Forest). *Contact: William Schuster.*

Coyotes of the Hudson River Highlands and the New York Bioscape Initiative. Fred Koontz (Wildlife Trust). *Contact: Fred Koontz.*

Floristic Changes Over Time in the Black Rock Forest. Kerry Barringer and Steve Clemants (Brooklyn Botanic Garden). *Contact: Kerry Barringer.*

The Effect of Leaf Longevity on the Carbon Gain and Growth of Japanese Barberry (*Berberis thunbergii*). Kevin Griffin (Lamont-Doherty Earth Observatory). *Contact: Kevin Griffin*

Hydrologic and Chemical Fluxes in the Black Rock Forest. H. James Simpson (Lamont-Doherty Earth Observatory of Columbia University). *Contact: H. James Simpson.*

Long-Term Studies of Painted Turtle Population Dynamics and Dispersal. David Karrmann and Christopher Raxworthy (American Museum of Natural History). *Contact: David Karrmann.*

Delineating Detailed Ecological Land Units in the New York Bioscape Using Multi-Temporal Landsat Imagery. John Mickelson (CIESIN at Columbia University), William Schuster (Black Rock Forest), and Fred Koontz (Wildlife Trust). *Contact: John Mickelson*

Taxonomic Inventory of the Black Rock Forest in Relation to Environmental Stability: A Voucher-Based Field Collection. Angélique Corthals and Julie Feinstein (American Museum of Natural History). *Contact Angélique Corthals.*

The Potential Role of Physiology in the Age-Related Decline of Red Oak Productivity at Black Rock Forest. Kevin L. Griffin (Lamont-Doherty Earth Observatory) and Will Bowman (Center for Environmental Research and Conservation at Columbia University). *Contact Kevin Griffin).*■

Consortium Bridges Science/Education Gap

The Black Rock Forest Consortium's innovative collaboration of colleges and universities, K-12 public and private schools, and scientific and cultural institutions enables it to "link teachers and learners to science research … it bridges the gaps between learners and scientists, takes the teaching and learning of science out of prepackaged labs and decontextualized textbook-based lessons, and exposes students to the scientific process through the use of real data, hands-on experimentation, examination of working systems, modeling, and anchored instruction."

That's one of the conclusions of the research Dr. Nicole A. Buzzetto-More conducted for her doctorate in education from Teachers College of Columbia University. Entitled "The Black Rock Forest Consortium: A Narrative," Dr. Buzzetto-More's dissertation provides a history of the Forest and the founding of the Consortium, discusses many of the Consortium's educational programs, and evaluates them in the context of current ideas about enhancing science education through real scientific inquiry.

"My goals were to depict how the Consortium's collaborative nature and unique make-up are helping to bridge gaps between scientific practice and science education," explains Dr. Buzetto-More, now a professor in the human ecology department at the University of Maryland, Eastern Shore, "and to provide inspiration and suggestions for future similar collaborations."

Her dissertation is available in the Forest library. "Together," notes Executive Director Dr. William Schuster, "Neil Maher's paper on the Forest's land-use history [see "Black Rock's Hidden Past," Spring 2004]; the 1930 *BRF Bulletin* "The Black Rock Forest," by the Forest's first director, Dr. Henry Tryon; George W. S. Trow's essay *The Harvard Black Rock Forest*, recently republished in book form by the University of Iowa Press; and Dr. Buzetto-More's dissertation provide an excellent long-term history of the Forest and associated activities over more than two centuries."■

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Forest News in Brief

2005 Small Grants Available. The Consortium has announced its 16th annual Small Grants program, with awards of up to $5000 for scientific research and up to $3000 for education projects conducted in the Black Rock Forest. This program is funded by a generous grant from the Ernst Stiefel Foundation. Grants, awarded on a competitive basis, can support purchases of equipment, summer stipends for students, transportation costs, and other needs. Housing facilities are available. Guidelines and application materials are available from Consortium institutional representatives and from the Forest web site (click on either Research or Education, and then on Small Grants). Proposals are particularly solicited for studies of ecosystem carbon balance and the dynamics of long-term ecological change. Consultation with the Forest Director is suggested. The deadline is February 1.

Summer Undergraduate Field Ecology Course. The Center for Environmental Research and Conservation at Columbia University, in collaboration with the Columbia Center for New Media Teaching and Learning, will hold its Summer Ecosystem Experience for Undergraduates (SEE-U) program at Black Rock Forest this summer. Students who enroll in one of the two five-week sessions (May 28-July 2 or July 16–August 20) will study biomes, biotic and abiotic processes, and conservation biology issues through a combination of lectures, field and lab work, independent projects, and web-based exercises, and will digitally network with students at SEE-U sites in Brazil and the Caribbean. More information is available at www.see-u.org/index.html; deadlines are March 15 for applications and February 10 for financial aid.

Forest Goes Wireless. Take your laptop outside! Wireless internet access is now available in the vicinity of the Center for Science and Education and the Forest Lodge.

Make Your Lodge Reservations. Prime periods during the spring of 2005 are still available, and Consortium members can stay in the new Forest Lodge for $20 per person per night. Call the Forest office for reservations.

Grants: Thank You! Thanks to State Senator William Larkin, the State Department of Environmental Conservation is awarding a $40,000 grant to the Black Rock Forest for its solar panel project. Thanks are also due to First Environment, an environmental and engineering services company with an office in Mountainville, NY, for donating $10,000 for design and construction of a new science activity area in the lower level of the Forest Lodge, to be used for classes and the trout breeding program.

Funding Opportunities. In addition to the above grants, the Consortium still needs to raise about $60,000 to complete the solar panel project and another $60,000 to complete the lower level facilities in the Forest Lodge; funds are also needed to support the cost of the new "green" kitchen. These spaces — and others in the Lodge — can be named after major donors, if desired. A brochure describing these funding opportunities is available; please contact Executive Director Dr. William Schuster if you are interested in sponsoring spaces in this beautiful new facility or if you know of any possible funding sources. ■

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Small Grants Deadline February 1
See page 7

Inside This Issue

Report from the Forest Manager

Change is common to all living things, and our woodlands constantly demonstrate change. Some are quite abrupt and easily seen, such as the defoliation and mortality of hemlock stands caused by the wooly adelgid. Other changes are more gradual, such as the slow establishment of sugar maple seedlings in an oak-dominated forest.

A change in the deer herd has become evident during the past five years. Many local outdoorsmen and homeowners have observed that there are more deer near human dwellings than in the woods. Those who have had an encounter via a car collision or overbrowsed landscape easily conclude there are too many deer. Hikers, hunters, and deer all seem to agree that there are fewer deer in the usual forest haunts than before. Of course, this might be explained by the cyclic nature of deer populations. But the deer density virtually triples in less than one mile from the Forest to just across bordering highway 9W. Monitoring of deer health from harvest measurements, deer population densities by winter tracking censusing, and available energy by calculating mast crops of acorns during the same period demonstrates few unexplained biological factors that normally affect deer.

To investigate this current phenomenon, one must go back to 1999. This was the year of extreme drought, forest fires, hurricane Floyd, and no mast crop. These conditions forced deer to migrate to the lower elevations of their range. This is a common reaction by deer to such conditions; they reverse the migration when conditions allow (e.g., good acorn crops).

After another poor acorn crop in 2000, the oak trees rebounded with a bumper crop in 2001. Deer densities rose slightly in the Forest but not to the degree expected, and deer densities remained high in lower elevations. Possibly, deer were newly discovering fertilized lawns, planted trees, and shrubs and flowers in their recently developed lower range and found it hard to leave.

Not too long ago, deer would have been greeted by a bullet if they wandered too near a dwelling or garden. At that time, the families would have been thankful for the good fortune of much needed fresh meat. Now, who is getting the last say in a people vs. deer environment? After a particularly hard winter in 2003, the lower elevation deer herd continued to establish new populations, with fawns born in neighborhood backyards. This also had the effect of luring bold coyotes nearer human communities.

What will lure deer away from this oasis of food, water and shelter? Possibly, with the rise and saturation of deer density in suburbia, territorial behavior will come into play, and surplus deer will be reluctantly pushed back to the woods. The population dynamics of local forest deer have become increasingly affected by the overbrowsed forest and by human development.

How will deer react in the long run? How will people react? Are there related public health issues? How will the Forest fare in the long run? There are many intriguing questions and many answers waiting to be found by serious students looking for serious projects.■

— *John Brady*