BLACK ROCK FOREST NEWS

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Solar Energy Starts to Provide Electricity for Forest

November has some of the shortest days of the year, but Black Rock Forest's new solar power system produced enough energy to offset half the electricity use of the Center for Science and Education during a short period of power generation during installation. "This is an auspicious beginning," says Executive Director Dr. William Schuster. "With full operation starting at the beginning of 2006, we can look forward to even greater energy production in the spring, summer, and fall as the days grow longer and the sun rises higher in the sky." Northern Power Systems, the producer of the photovoltaic panels and prime contractor for the project, estimates that the system will provide nearly 29,000 kilowatt-hours (kWh) per year.

Solar panel roof over steps from parking lot.

The Forest's system has three components: 40 photovoltaic panels on the south-facing roof of the Science Center, 32 on the roof of the new pavilion, and eight on the new roof over the steps from the parking lot. These panels are connected first to inverters in the basement of the Science Center that convert the direct current they produce into alternating current and then to the main electrical panel for distribution throughout the building. The electricity produced directly offsets electricity supplied by Central Hudson, and can even be returned to the main grid if production exceeds use. "We anticipate saving thousands of dollars per year," says Dr. Schuster, "with higher savings if electricity costs continue to rise."

A Regional Example

When people think of solar power, they often think of California or Florida, but not of the northeast or the Hudson Valley. Black Rock's new system not only benefits the Consortium financially and educationally, but can also demonstrate to the larger community that production of electricity through solar power is viable in this area. "As a larger non-residential system, the Forest's solar array is pretty unique in Orange County," notes environmental planning consultant Simon Gruber who, along with other activities, organizes conferences about green building practices and conducts tours of green buildings, including Black Rock's Science Center and Forest Lodge (for information, contact him by e-mail or at 845-534-5622). "It's real, and it's working, and it can serve as an important example to other organizations and to businesses in the area." New York State has a "very ambitious" solar power incentive program, he notes, paying half the cost for any home or business, up to a cut-off point (information about the state programs is at www.getenergysmart.org).

"What's really exciting," he continues, "is the way Black Rock's

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Urban-Rural Gradient

Impact of Cities on Plant Growth

Last spring, scientists at Black Rock Forest started a multiyear research project with the long-term goal of finding new ways to quantify the "ecological footprint" of cities on the areas around them. Located centrally along a gradient from intensely urban New York City to completely rural areas such as some parts of the Catskill Mountains, the Forest is an excellent location from which to launch such a project, notes Executive Director Dr. William Schuster, one of the scientists participating in the study.

The project will examine urban-to-rural gradients in environmental variables such as day- and nighttime temperatures, growing season length, incident diffuse radiation (indirect radiation that is scattered by the atmosphere), chemical deposition (especially of compounds containing nitrogen and sulfur), and ozone and carbon dioxide (CO_2) concentrations, and will investigate their individual and interacting influences on native plant growth – and, eventually, on forest ecosystem function.

The Study

A 2003 study by Jillian Gregg *et al.*, published in *Nature*, demonstrated, surprisingly, that potted eastern cottonwood (*Populus deltoides*) seedlings grew better in New York City than in more remote rural areas. However, the study did not identify any mechanisms for this result, the species studied is not native to local forests, and the clone used is not responsive to variations in CO_2. In contrast, this new study will investigate physiological differences along a transect from the city

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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 3785-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

It is heartening to see cases where environmental laws have succeeded in their intended purpose. The Clean Water Act is a good example. Our society recognized that pollution was fouling our waters, Congress subjected discharges to regulation, and the Great Lakes, the Hudson River, and water resources all around our country improved dramatically. The Surface Mining Control and Reclamation Act of 1977 changed the way strip mines were operated and required environmental protections; now, most mined lands are returned to a productive state after mining and water quality has been restored in many streams in coal mining areas.

Congress originally passed the Clean Air Act in 1963 and substantially amended it over the years, especially in 1990 when it required lower emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), precursors of acid precipitation, from electricity generating stations. Scientists working at the Hubbard Brook Experimental Forest in New Hampshire had documented the existence and negative impacts of acid precipitation, and these 1990 amendments to the Clean Air Act were intended to reduce this form of pollution.

In a recent Ph.D. thesis, Josslyn Shapiro from Columbia University's Department of Earth and Environmental Sciences examined long-term trends in inputs of acidic hydrogen ions, sulfate, and nitrate to the Black Rock Forest area, both before and after these regulatory changes [see "Precipitation, Stream Chemistry Key to Ecosystem Processes," Winter 2005].

In analyzing results from the National Atmospheric Deposition Program facility that the Consortium operates just south of the Forest, Ms. Shapiro found a 36% decrease in hydrogen ions, a 35% decrease in sulfate concentration, and a 23% decrease in nitrate concentration in precipitation between 1981 and 2003. These concentration decreases resulted in similar reductions in total wet deposition of these compounds. The reductions were consistent with emission reductions around the region, indicating that Clean Air Act pollution controls have really worked to our benefit in this area.

Ms. Shapiro also looked at results from a series of stations that attempt to quantify dry deposition of acidic compounds — aerosols and gases that settle out of the air when it is not raining. These data, while from a shorter time period, indicate that dry deposition of sulfur also declined from 1990 through 1996.

But these dry deposition estimation methods are fraught with uncertainty as they model, rather than directly measure, the amounts that are actually deposited on surfaces in the Forest. Another way of estimating dry deposition is to compare precipitation inputs with stream exports: if exports are greater than precipitation inputs, the remainder should be entering as dry deposition, unless there is another source. Using this mass balance approach, Ms. Shapiro estimates that dry deposition of sulfur may in fact be as much as two times higher than wet deposition.

Despite that fact, sulfate export from Black Rock Forest's Cascade Brook did decrease between 1997 and 2005, indicating a response to decreasing regional and local SO_2 emissions and sulfate in precipitation since the 1990 Clean Air Act amendments. Streams in the Forest are still running acid, although we have noticed some improvement in pH over the decade or so in which we have monitored stream acidity. Some of Ms. Shapiro's data indicate that we should expect a lag time between emissions reduction and water quality improvements.

Thus, long-term historical analyses indicate that laws regulating emissions have reduced acid deposition. We are beginning to be able to quantify the reductions and document the implications for water quality and the health of our biota. In many people's minds, these reduced acid deposition levels are still too high for environmental health and further regulation is needed, including providing incentives for reducing emissions. Hopefully, we are approaching the day when we will be able to quantify exactly the costs and benefits that result from various levels of emissions and decide as a society what we want and are able to afford. ■

— Dr. William Schuster

Weekly Visits to Forest for Montessori School

If it's Tuesday, it must be the Black Rock Forest – for students at the Metropolitan Montessori School, that is. Each week, all year, a group of 13 students, from kindergarten through sixth grade, takes a field trip to the Forest, accompanied by Ric Fry, director of the school's environmental stewardship program, and a classroom teacher. "I think of Black Rock as our rural campus," wrote Mary Gaines, Montessori's head, on the front page of the school's newsletter. "It offers the perfect means of teaching Montessori city kids about the natural world, and equips them with hands-on scientific experience and knowledge they need to be ethical choice makers and effective problem solvers."

The Montessori School has been committed to environmental stewardship for years. Students tend the rooftop garden and greenhouse (produce from the garden shows up in school lunches, along with other locally grown food), study trees and help tend pathways in neighboring Riverside Park, care for street trees on the school's block, and learn about Hudson River ecology and water issues through trips on the school's boat. "Black Rock Forest is a perfect match for the school," says Ric Fry. "It's close to the city, but outside it, and brings our students in contact with so much more biodiversity than the park."

Montessori kicked off its Consortium membership with a September faculty and staff curriculum-planning retreat at the Forest, including an overnight stay in the Forest Lodge. They explored both educational opportunities (and their way around the trails) and how the Forest fits in with the Montessori commitment to building "vision, courage, imagination, integrity, gratitude, responsibility, and compassion in our classrooms and children, as well as in ourselves," as Assistant Head Bob Reveri put it after the retreat.

Activities for All

The Montessori philosophy calls for individualized education, with each student discovering his or her own interests, in multiage classrooms. Each group of students visiting the Forest thus engages in its own set of activities, determined both by the level of the students and by their interests. The schedule is set up so each group will go to the Forest in each season, always visiting the same location, allowing students to see changes over the course of a year.

The younger students focus on learning to identify what they see: different kinds of trees, leaves, rocks, and habitats. Older students study orienteering, water quality and macroinvertebrates, and tree diversity and ecosystem health. Reflection and journaling are important components of the program for all students; Ric Fry plans to collect their observations in a scrapbook so they will be able to see how their impressions evolve with repeated Forest visits.

Montessori students in the Forest.

Guidance from an Expert

As when other schools visit Black Rock, Forest staff members help the groups from Montessori. However, the school has taken the additional step of hiring Jamie Kamlett, a retired teacher from the local Cornwall school district who is extremely familiar with the Forest, to work with each group. "Jamie makes the Forest special for students," says Ric Fry. "He can explain the history of the Forest beyond what they see, tell stories, and explain who else visits the Forest and what they do. The students pick up on his passion and excitement." Each week, the two teachers discuss the class's interests, and develop the week's program together.

"Our Consortium always seeks ways to support members' needs and desires, whether it be for supplemental educators, outside experts, or particular equipment or facilities," explains Executive Director Dr. William Schuster. "We do have outstanding educators, such as Jamie Kamlett, not on full-time staff but well-versed in teaching in the Forest, who can be contracted to meet specific needs." Teachers from other independent schools who are interested in more information about working with an experienced local teacher may contact Ric Fry by e-mail or at 212-579-5525).

More than Forest Visits

Black Rock is not just a once-a-season visit for the students. Back in school, their teachers will integrate their Forest experiences and studies into their classroom lessons, making connections to math, language arts, and even music (bird song). Perhaps more importantly, the Forest trips have made students more excited and enthusiastic about everything they're studying, notes Ric Fry, who adds that the Forest is becoming part of the school's culture. He hears students asking each other, "When do you get to go to the Forest? When is it our turn?" Mary Gaines, the principal, reports that another teacher saw a student studying a piece of paper in a stairwell. When asked what he was doing, he replied, "I'm memorizing all the trails of Black Rock."

Visits to the Forest also serve a broader purpose. They help students learn to take on challenges; for some, for example, the solo walk is a "big deal," Ric Fry says, and they are "very proud" when they complete it. Mary Gaines notes, "As the delighted child studying the map suggests, Black Rock is a continuing invitation to travel down new roads, increase self confidence, and infuse learning with joy and purpose." And Bob Reveri says, "We seek for the children to fall in love with what they see and assimilate; if they love it, they will protect it all their lives." ■

Student Research Spotlight: Carbon Dioxide Efflux from Tree Trunks

by Will Bowman

Forests provide many important benefits and ecological services. They serve as habitat for an impressive diversity of flora and wildlife, remove pollutants from rainwater before these pollutants enter rivers and estuaries, and soak up 2 billion tons of carbon dioxide (CO_2) from the atmosphere annually. This CO_2 uptake mitigates against climate change by offsetting about one-third of the CO_2 emitted by fossil fuel combustion.

Every living surface in forests exchanges CO_2 with the atmosphere as CO_2 is taken up by canopy photosynthesis, while respiration in the cells of trunks and branches metabolizes the sugars produced by photosynthesis and returns CO_2 to the atmosphere. I studied these exchanges of CO_2 between forests and atmosphere in Black Rock Forest.

Specifically, I aimed to quantify the amount of respiratory CO_2 that diffuses from the trunks and branches of northern red oaks (*Quercus rubra*) in stands of different ages (40 to 135 years old) in the Forest, and how much of the total CO_2 removed from the atmosphere by photosynthesis in these stands is returned to the atmosphere by respiration from the trunks and branches. Most forests in the eastern United States are young; it is important to understand if their carbon uptake will change as they age.

I monitored CO_2 efflux from the trunks and branches of 20 trees from June to December in 2002 and 2004. To determine the physiological and environmental conditions that influence this efflux, I also measured wood temperature, respiration rates of the underlying wood, sap flow rates, sap CO_2 concentrations, and tree growth rates.

These measurements showed that trunk and branch respiration annually releases 4180-6300 kilograms of CO_2 per forest hectare into the atmosphere. This CO_2 flux is an important component of the carbon budget of these forests, accounting for 10.3 to 17.0% of total photosynthesis. Comparing respiration among stands, higher respiratory activity in the younger (40-yr-old) trees was offset by the greater biomass in the older (95-yr-old) stand, so this proportion did not vary by stand age. The variation in trunk CO_2 efflux was strongly related to wood temperature and was correlated with wood respiratory activity during the fall and winter and with tree growth rates in the spring and summer.

This research also found that sap flow and CO_2 within the sap interfere with the efflux of respiratory CO_2 to the atmosphere, and vary with the age of the trees. This suggests that, particularly in older trees, respiratory CO_2 may be transported by sap flow to upper regions of the tree. Research to identify conditions in which sap flow or CO_2 concentration interfere with trunk CO_2 efflux would improve our ability to accurately estimate this important forest CO_2 flux. ■

Will Bowman is about to receive his Ph.D in Ecology and Evolutionary Biology from Columbia University.

Solar Panels *(continued from page 1)*

commitment to demonstrating green design and environmentally sound energy production expands its outreach beyond Consortium members to the community and the region as a whole."

Jim Stover, Northern Power Systems' on-site sales engineer, notes "Although this is a small system for us, it provides a good opportunity to educate visitors about how the technology works, and will serve as a real-world example of the ever-expanding interest in and acceptance of clean, renewable energy." Northern Power's projects include the Ordway campus at the Woods Hole Research Center and a 400-kW system at Timberland's California distribution center.

A Cooperative Project

Black Rock's solar panel project began with a call from Northern Power Systems to Fox & Fowle Architects (now known as FXFOWLE), the designers of both Forest buildings, alerting them to the availability of grants from the New York State Energy Research and Development Authority (NYSERDA) to offset the cost of constructing solar power systems. Together with the Consortium, they applied for and received a grant of $129,000 to cover about 60% of the cost of the Forest's system; backed by the efforts of State Senator William Larkin, the state's Department of Environmental Conservation later provided another $40,000. The Consortium hopes to recoup its investment in the remaining cost in about ten years through reduced electricity bills.

Sylvia Smith, a principal with FXFOWLE, had designed the Science Center so it could accommodate solar panels, but the Forest plan called for additional photovoltaic arrays to create a 24-kilowatt system. Working with Dr. Schuster, Ms. Smith and FXFOWLE associate Paul Tapogna developed the idea of placing them atop a sheltered outdoor educational space (the pavilion) and a weather barrier for the stone steps. The roof over the stairway protects the steps from snow and ice, while the supporting columns allowed the installation of a handrail. "Architecturally," notes Mr. Tapogna, "this provides a gateway from the parking area with a sweeping panoramic view of the Science Center and the Forest Lodge at the top."

Northern Power Systems designed the photovoltaic system and supervised its installation, and Storm King Contracting built the new structures, installed the panels, and completed the electrical and site work. Red pine from the Forest frames the roofs of the pavilion and the stair covering.

Educational Opportunities

The photovoltaic system is linked to the Forest's existing environmental monitoring network, and will generate a variety of data including hourly power production, daily and monthly energy summaries with comparisons to simulations based on meteorological data, and irradiance information. "We plan to provide learning opportunities in sustainable design for a wide range of audiences through tours and demonstrations," notes Dr. Schuster, "as well as new curricula designed to examine the energy production and efficiency of the system. Production of instructional materials related to the panels and other "smart and green" features of the Forest buildings is one of the priority areas for this year's Steifel Foundation Small Grants" [see "Forest News in Brief," p. 7]. ■

Urban-Rural Study *(continued from page 1)* to the Catskills in three native plants: an herb, fireweed (*Erechtites hieracifolia*); a tree, red oak (*Quercus rubra*); and a shrub, witch hazel (*Hammamelis virginiana*).

The research team (Dr. Kevin Griffin of Lamont-Doherty Earth Observatory at Columbia University, Dr. Matthew Turnbull of the University of Canterbury in New Zealand, Dr. David Tissue of Texas Tech University, and Dr. James D. Lewis of Fordham University, along with Dr. Schuster) will gather at the Forest each spring to investigate the physiological and biochemical characteristics of the plants. Physiological and morphological measurements will be made each spring and at the end of each growing season.

The First Year

Early last summer, the researchers established study areas at four sites: Swindler's Cove Park in upper Manhattan, the Lamont-Doherty Earth Observatory in Palisades, New York, Black Rock Forest, and the town of Olive in the Catskills. Thirty fireweed plants and 30 oak seedlings, all in large, well-watered pots, were grown at each site.

Dr. Griffin and Dr. Turnbull (along with Drs. Tissue, Lewis, and Schuster) examined respiration patterns in the red oak seedlings. For plants, respiration is the "opposite" of photosynthesis; it is the process through which they absorb oxygen and release CO_2. It can consume between 30 and 70 percent of the carbon fixed by photosynthesis and, on a global basis, annually releases some 60 gigatons of carbon into the atmosphere. Unlike animals, which only use oxygen to generate energy, plants (and microbes) have another, alternative, biochemical pathway that uses oxygen without generating energy, but its purpose is not clear.

The researchers wanted to test the hypothesis that this alternative pathway "plays a central role in the acclimation of plant respiratory capacity to environmental change," in particular to temperature. Their preliminary data for the first year show that the capacity for this alternative use of oxygen increased along the gradient from the warmer New York City site to the cooler Catskills, indicating that in oak trees this secondary respiratory pathway is important for the maintenance of metabolic activity and a positive carbon balance even in cool night-time temperatures. The researchers hope that a mechanistic understanding of respiration will lead not only to a better understanding of the environmental controls on the growth of oak trees but also to a predictive understanding of how our local forests will respond to global climate change.

Dr. Schuster, Dr. Lewis, and Columbia University graduate students Will Bowman and Chengyuan Yu investigated differences in biomass growth in the fireweed plants. While the seeds all came from one location and were planted in the same soil and pots, their growth patterns varied dramatically among the sites. Plants in the city grew tall, but with light above-ground parts and greater production of roots. Plants in the Catskills produced the most biomass. The plants at intermediate sites showed even different results, indicating that different suites of environmental factors can cause very different growth patterns. The researchers will analyze tissue samples to determine if factors such as carbohydrate storage explain the growth variations, and will repeat the experiment next year to see if the results are consistent.

Kevin Griffin with oak seedlings.

Additionally, Dr. Dan Yakir, the head of the Department of Environmental Sciences and Energy Research at the Weizmann Institute of Science in Israel, on sabbatical at Columbia, ran isotope analyses from respired air from oak leaves from each of the four sites, but the research group has not yet had time to analyze the results.

The School Connection

Recently, the Calhoun School, an independent K-12 school in New York City and a Consortium member, joined the study, planting acorns on their new green roof to establish another urban site for the study. Calhoun's green roof, opened last spring, was designed by FXFOWLE (the architectural firm that designed Black Rock's two buildings) to provide educational, esthetic, and environmental benefits. Teachers will use the roof to integrate water chemistry, plant biology, and solar energy topics into their existing curricula, and will collaborate with other organizations, such as Black Rock Forest, to enhance their own efforts.

Francesco Filiaci, the school's upper school biology teacher and director of the green roof, encouraged one of his 11th grade students, Barbara Fenig, to take on the project as a two-year commitment. She planted the acorns in one of the 4-foot by 4-foot plots on the roof and will look after them, help take measurements, and visit the Forest to participate in the study.

The Future

After this first pilot year, the scientists hope to expand the project to include additional sites in New York City and surrounding areas, the shrub witch hazel, wild (not potted) oaks and shrubs, and additional environmental variables and physiological and biochemical measurements. "Respiration is the process that is closest to my research interests," notes Dr. Griffin, "but ultimately I expect the research to have a more general focus on plant carbon balance; we will delve into photosynthetic responses, leaf carbohydrates, whole plant growth, and carbon allocation." Eventually, the study may be expanded to the community and ecosystem scales.

"Ultimately," concludes Dr. Schuster, "we would like to understand the environment of urbanized areas well enough to predict the consequences of human actions and to manage our natural resources in a sustainable fashion over the long run." ■

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. ■

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.*

Forest Sustainability and Response to Canopy Disturbance. William Schuster (Black Rock Forest), Shahid Naeem and Maria Uriarte (Columbia University), Kevin Griffin (Lamont-Doherty Earth Observatory of Columbia University), and Jerry Melillo (The Ecosystems Center, Marine Biological Laboratory). *Contact William Schuster.*

Native Plant Performance along an Urbanization Gradient. Kevin Griffin (Lamont-Doherty Earth Observatory of Columbia University), William Schuster (Black Rock Forest), and J. D. Lewis (Fordham University). *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.*

Carbon and Nitrogen Cycling in the Cascade Brook Watershed of Black Rock Forest. Kevin Griffin and H. James Simpson (Lamont-Doherty Earth Observatory of Columbia University). *Contact: Kevin Griffin or H. James Simpson.*

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.*

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

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

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

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 of Columbia University) and Will Bowman (Center for Environmental Research and Conservation at Columbia University). *Contact Kevin Griffin.*

The Insect and Arachnid Diversity of Black Rock Forest. Vladimir I. Ovtsharenko (American Museum of Natural History). *Contact: Vladimir I. Ovtsharenko.* ■

Let It Snow!

This winter, Black Rock Forest has added a dual-use snow research station to its existing array of environmental sensors – dual-use because it spent time this summer on an ice floe in the northern Laptev Sea, an arm of the Arctic Ocean. The station will measure snow depth, snow pack temperatures, snowfall, the snow-water equivalent, and light and heat from the snow and the ground, adding to Forest snowfall records dating back to 1961, says Jessie Cherry, the project manager, who is completing her doctorate at Lamont-Doherty Earth Observatory of Columbia University.

Snow is a major contributor to the area's freshwater supply: although only 15-20% of annual precipitation, it accounts for some 30% of the water runoff, which in turn supplies 96% of the water used by homes, businesses, and industry. As population and water demand increase, and as regional climate changes may contribute to reduced snowfall, it is vital to understand the role of snow in the area's hydroclimatology and water resources. Further, measuring snow cover and below-ground temperatures can add to the scientific understanding of basic snow physics, including the coupled relationships between land and atmospheric temperatures.

"Snow research at Black Rock Forest has attracted tremendous interest," notes Ms. Cherry. She and her Lamont-Doherty colleagues Dr. Bruno Tremblay and Dr. Jason Smerdon plan to work, together, and separately, with researchers from the City University of New York, Rutgers University, and Columbia's Department of Earth and Environmental Engineering to study the impact of snowfall and the snowpack on mercury emissions, vertical and horizontal transport of heat through the snowpack, drivers of snowpack melting, impact of snow cover on ground temperatures, and the role of snow in regional water resources and how that may change in a warming climate.

"With this additional instrumentation," Ms. Cherry concludes, "Black Rock Forest can become an exemplary snow research station for studying hydroclimatological change." ■

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Forest News in Brief

2006 Small Grants Available. The Consortium has announced its 17th 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. Proposals are particularly solicited for projects that enhance the availability of scientific information through the Forest web site, research on forest ecosystem sustainability and response to disturbance, studies of plant and ecosystem function along urbanization gradients, and production of instructional materials related to the new solar panel arrays and other "smart" and "green" features of the Science Center and Forest Lodge. Guidelines and application materials are available from Consortium institutional representatives and on the web at www.blackrockforest.org/2006SmallGrantsGuidelines.htm. Consultation with the Forest Director is suggested. The deadline is February 1.

Openings at Forest Lodge. While many visitors to the Forest prefer spring and fall, winter and summer are also wonderful times to stay overnight in the Forest Lodge. Openings are now available for February, March, and July through September, as well as scattered dates in other months. For more information about availability, booking space, and interesting seasonal research and education opportunities, please contact Operations Manager Jack Caldwell in the Forest office at (845) 534-4517 or by e-mail, or on the web at www.blackrockforest.org/consortium/lodge/index.html.

Black Bear Natural History Program at Forest. On April 8, the Consortium, the Cornwall Conservation Advisory Council, and the Museum of the Hudson Highlands, will sponsor a presentation on black bear natural history by Matt Merchant, a wildlife biologist in New York State's Department of Environmental Conservation. "New York Black Bear: Friend or Foe" will cover bear biology, population trends and range, conflict avoidance, and the DEC's role in bear management. As Executive Director Dr. William Schuster notes, "While bears are only present at very low densities and are generally uninterested in humans, human actions can either minimize or greatly increase the incidence of bear-human conflicts. A little education, disseminated widely, can help us all coexist!" For more information, please contact the Museum (845-534-5506).

New Members Join Consortium Board. The Consortium's board includes at-large members in addition to representatives from its member institutions. This fall, Frances Degen Horowitz and David Redden joined the board as at-large members. A developmental psychologist, Dr. Horowitz recently retired as the president of the City University Graduate Center and is a fellow of the American Academy of Arts and Sciences. Mr. Redden, vice-chairman of Sotheby's and a Cornwall neighbor of the Forest, is a committed environmentalist and a long-time board member of Scenic Hudson. Welcome to both! ■

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Small Grants Deadline February 1 See page 7

Inside This Issue

Report from the Forest Manager

Where have all the deer gone? Into my backyard! That's the usual answer these days. Well, how did they get there? They probably walked. But what caused this unusual migration to the areas they once avoided and seemingly feared? Where white-tailed deer were pushed to the brink of extinction during the first half of the twentieth century, they are now cozying up to humans to the point of coming over for dinner.

Many factors must be considered to explain the movement of core deer groups from the forest to lawn ornaments. First, it must be understood that a deer's home range always included backyards, but these were only visited occasionally. To narrow down why deer have concentrated their activities in this small part of their home range, influences inside the rest of their range must be analyzed.

Deer have recently been influenced by many range-affecting factors. Easily seen from the peaks of Black Rock Forest is the increasing development and urbanization of old farmland, ever downsizing the territory of deer. Meanwhile, back in the Forest, conditions for deer survival and growth have not been favorable, contributing greatly to their movement out of the Forest. Since the large healthy herds typical of the late 1980s and early 1990s, Forest populations have been reduced by a combination of environmental factors.

First, the March 14, 1993, blizzard (20 in of snow), compounded by the absence of the critical acorn crop in the previous fall, began the reduction and migration of Forest deer. As populations started to recover, the harsh winter of 1996 (108 in of snow) slowed herd growth. Next, the Forest experienced the fires and drought of 1999 and the destructive 11-in rainfall of Hurricane Floyd. Combined with a total collapse of the acorn crop, this led to deer densities in the Forest that were at a 40-year low. The tracking census of the winter of 2000 calculated a deer over-wintering density of only 15 deer per square mile.

But there's more. While these factors directly affected the Forest and wildlife, the woolly adelgid had begun its mortality-inducing defoliation of hemlock trees that had sheltered deer from the heat of summer and the cold and snow in winter. Shelter now can only be found in dense mountain laurel stands or maybe under the manicured conifer trees that make our backyards so inviting.

Last but not least, coyotes have to eat too. They definitely impact deer herds, but to what degree is uncertain in this area. Fawns at birth and during their first winter seem to be most susceptible. The herding and chasing tendencies of coyotes in the Forest may have caused deer to seek sanctuary near human dwellings where only the boldest coyotes will venture.

Now that they are in our backyards, what will make them move out? If nature pushed them here, maybe she can lure them back to the forest by producing enticing mast crops and mild winters. With the increased deer numbers in backyards, their health may suffer, and a reverse migration may occur as a result of deer social and territorial behavior.

These poor deer, how do they survive? Very well thank you! ■

— John Brady