BLACK ROCK FOREST NEWS

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Study Assesses Potential for Native Brook Trout Restoration

Can the Eastern brook trout (*Salvelinus fontinalis*), New York's state fish, be restored to its former habitat in the streams of the Hudson Highlands? With generous funding from the Sarah K. de Coizart Article TENTH Perpetual Trust, the Black Rock Forest Consortium has completed a study to determine its restoration potential. From 2008 to 2010, the Consortium assessed brook trout populations throughout the Highlands to provide a baseline for establishing priority zones by identifying places in which protection and restoration should be focused.

The Consortium collaborated closely with partners during the study, including Bear Mountain, Harriman, and Sterling Forest State Parks; the Environmental Management Bureau of the New York State Office of Parks, Recreation and Historic Preservation; Region 3 of the state Department of Environmental Conservation (DEC); West Point Military Academy; Eastern Brook Trout Joint Venture; Trout Unlimited; Dr. Fabio Corsi, a conservation biologist from Columbia University; and Dr. Alan Wells, the Consortium's consultant on this project, who is an aquatic biologist familiar with brook trout populations in the Highlands. The de Coizart funding permitted hiring two college students to work with staff and Dr. Wells on the assessment, and through other funding the Consortium was also able to offer educational activities to other students on projects related to trout but not part of the restoration assessment itself.

Operations Manager Jack Caldwell and Columbia undergraduate Michelle Lacks geared up for stream surveys.

The Brook Trout

"Native brook trout populations in New York have been greatly reduced after two centuries of human-induced changes to their habitat," explains Consortium Executive Director Dr. William Schuster. "The cold, clear streams that sustain brook trout (because they contain high levels of dissolved oxygen) have been altered by deforestation and resultant stream warming and sedimentation, as well as acid rain and other forms of pollution. Development and dam building have fragmented habitat, while stocking of streams with brown trout and other non-native and invasive species to enhance sport fishing led to brook trout being outcompeted. Clear-cutting for agriculture, tanning, and charcoal and iron production took a heavy toll."

In recent decades, conservation has become a priority in the Hudson Highlands, with forest regrowth and improved land management policies leading to recovery of riparian habitat. Statewide, the DEC has worked to prevent native brook trout extinction and improve conditions for their survival. In the western Highlands, state parks and large private and public landowners have preserved a 100,000-acre ecosystem zone of strategic importance to species restoration efforts. "Nonetheless," Dr. Schuster continues, "much of the habitat is still impaired, because aggressive, non-native fish populations

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Member Profile

AMS Thrives on Forest Activities

"It's nearly impossible to take an uneducational trip to Black Rock Forest," says Tom Zavrel, a science teacher at the Urban Assembly School for Applied Math and Science (AMS) in the Bronx. In just two years of membership, AMS has made extraordinary use of the Forest, with activities ranging from staff development to practicing experimental design in an ecological context to studying sustainable design and renewable energy to enrichment programs for advanced high school students. Over this school year, some 280 of the school's 630 students (all from grades 6-12) will visit the Forest.

"It is incredible how quickly Black Rock has become so integrated into all levels of our school," says principal Ken Baum. "Stop a random student in a hallway here, say the words 'Black Rock,' and watch the eyes light up and face broaden to a smile, and listen for the inevitable: 'when can we go again?' Black Rock has forever changed the way our students and staff think and feel about science."

During the fall, the entire sixth grade (more than 90 students) visited Black Rock to apply their classroom studies of the scientific method in the Forest. "Our sixth grade curriculum focuses on hypothesizing, data collection, and making and supporting conclusions based on data," explains David Krulwich, the assistant principal. "Before the trip, they made hypotheses about what things might be different in ponds at different altitudes, like temperature, acidity, air pressure, and the fish or plants in the water." At the Forest, the students hiked to several ponds,

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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 3835-acre Black Rock Forest in New York's Hudson Highlands.

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American Museum of Natural History
Barnard College
The Browning School
The Calhoun School
Central Park Conservancy
Columbia University
Cornwall Central School District
The Dalton School
Frederick Douglass Academy
The Hewitt School
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Black Rock Forest News
Sibyl R. Golden, Editor

Report from the Executive Director

Snow is an important component of northeastern forest ecosystems, although we do not always appreciate it. As I write in mid-January, our region has received abundant snowfall, Since our environment is dynamic and changes with time, it would be valuable to understand how the amount of snow we receive has changed and will change in the future, and what the likely consequences will be.

During the 20th century, the northeast underwent an average annual temperature increase of 1ºC, largely due to winter warming. Current climate models agree that temperatures in this region will continue to increase. There is less agreement on how precipitation will change, but a reduced winter snowpack, with more runoff in winter and less in spring, is expected. Black Rock Forest and the Highlands lie along the southern border of a cool temperate region where winter snow cover (for at least 30 days per winter) has been consistent and dependable. But climate models project that the southern region of warm and humid climate will expand northward. By the last decades of the 21st century, only the Adirondacks and northernmost Appalachians are expected to still have reliable winter snowpack.

What will be the consequences of reduced snow and snowpack? A longer growing season and increased plant growth are possible, but not certain. If temperatures continue to rise, the region could experience drier growing-season soils and reduced growth of drought-sensitive plants. Tree species that are limited by winter temperatures may experience increased growth and carbon uptake. Because it contains trapped air that gives it an extraordinary insulation value, snowpack acts as a blanket, insulating soil and preventing it from freezing. Roots are the least cold-hardy organs of most plants and reduced snow cover has been shown to increase root mortality due to freezing, reducing growth in tree species adapted to a winter snowpack.

Changes in snowfall and snowpack have other effects too. Winter temperature increases can increase microbial activity, nitrogen cycling, and decomposition. But soil freezing events that cause root mortality can lead to increased nitrogen leaching from soils into streams, potentially threatening soil productivity and water quality.

Many animals seek shelter from harsh weather in the snowpack; for some species it is critical to their survival. A thick snowpack provides stable temperatures, constant humidity, and protection from wind, greatly reducing energy demands on active animals like voles, shrews, and mice. This environment below the snow also provides protection from predators, and the snowpack helps insulate animals that hibernate. Other native species like deer, turkey, and fox are not well equipped to deal with deep snow and lose much of their body weight surviving in winters with deep and persistent snow cover.

Black Rock Forest snowfall records date back 50 years to the winter of 1960-1961. Consistent with climate models, there was a strong trend of decreased winter snowfall from 1960 through the mid-1990s. The snow that did fall also got wetter, on average, over time. But annual snowfall amounts have increased in the last 15 years, mainly due to a greater number of large winter storms. Since the Forest's snowpack measurements began in 1996, it has averaged 73 days of snow cover per winter; this measurement period is not long enough to detect temporal trends. The Forest's recently installed snow station will ensure accurate recording of the most important climate parameters. But it still remains to be seen if snowfall and snowpack will decrease as the models predict.

Skiers would benefit from more snow, while shovelers and travelers will be happy if there is less snow in our future. Some plants and animals would benefit from less snowfall and a longer growing season, but others will suffer without a protective snowpack. We do not know how snow and snowpack will vary in the future, in part because so many factors influence the form of precipitation we receive (snow, ice, or rain) and snowpack metamorphosis, melting, and evaporation. But beyond our concerns about tired backs, road driving conditions, and recreational opportunities, other native organisms have a large stake in this matter too. ■

— Dr. William Schuster

Festive Cocktail Benefit Aids Black Rock Forest

More than 100 guests mingled with friends and Consortium scientists, learned about the Forest, and listened to a thought-provoking presentation by ecologist Dr. Daniel Botkin, author of *Discordant Harmonies* and many other books, at Black Rock's cocktail benefit on September 30 at the Century Association, netting more than $50,000 for the Consortium's programs in the process. The event was co-chaired by Richard Bartlett, the chairman of the Consortium's Leadership Council (see "New Leadership Council Builds on 20th Anniversary Celebration," Spring 2010), and Sibyl R. Golden, the Consortium's chair, and supported by a hard-working committee that included board members, Leadership Council members, and other friends of Black Rock Forest.

After Dr. Schuster briefly outlined the Consortium's diverse scientific, educational, and conservation activities, Dr. Botkin, a professor emeritus in the Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara, who has worked on a broad range of ecological issues, noted that Dr. Benjamin Stout, one of Black Rock Forest's early directors, was on his PhD committee and had become "a lifelong friend and colleague."

Dr. Botkin then spoke about "the idea that there is no balance of nature, . . . that change is natural and that everything about nature — populations of wildlife, forests like Black Rock, life at a planetary level — is always changing, has always changed." Drawing on his experience directing a salmon conservation program for the state of Oregon and a study that analyzed the effect diverting water flowing into California's Mono Lake would have on the water in the lake and hence on migratory birds that use it, he emphasized the importance of measurements, population counts, and other quantifiable data to understanding environmental issues. A lively question and answer period ensued.

"Our 20th anniversary luncheon was a huge success," says Dr. Schuster, "but is not something a small organization like Black Rock Forest can undertake every year. We are thrilled that a cocktail party can also be such a successful way for us to introduce new friends to the Consortium and its work while also raising money we need to carry out our programs. We are very grateful to the co-chairs and the committee for organizing it. We expect to hold other cocktail benefits with prominent speakers annually, starting in the spring of 2012, and another special event for our 25th anniversary in 2014." ■

Two New Members Join Consortium

The Black Rock Forest Consortium was pleased to welcome two new members in 2010: the Hewitt School and the New York City Department of Parks and Recreation. Both are excited about the opportunities the Forest offers them.

"Membership allows us to expand our campus, complete scientific observation and investigation on site in the Forest, and explore aspects of the arts, history, and writing in a beautiful new setting," says Elizabeth Stevens, the academic dean of the Hewitt School, an independent K-12 girls school in Manhattan.

So far, students from grades 2 and 3 learned about dendrology, mammals, and plant life; grades 7 and 8 went snowshoeing and enjoyed indoor exercise as part of a week-long wellness course; students in grade 7 took hikes and made nature observations; 10th graders analyzed water quality and studied nature writing, using Thoreau and Annie Dillard as models; and 12th graders took part in team-building.

"Our 10th grade trip was a good example of the kind of interdisciplinary work that is possible in the Forest," Ms. Stevens explains, "as it combined chemistry and English. Most of our activities have evolved out of our curriculum, with the exploration of the Forest then informing our program. We are looking forward to collaborating with other schools through the Consortium."

The New York City Department of Parks and Recreation has already used the Forest in a variety of ways, including professional development for its Urban Park Rangers and foresters in its Natural Resources Group, and as a peak experience field trip for New York City high school students participating in the Department's Ranger Conservation Corps after-school program. "After getting their hands dirty on projects in city parks," says Sarah Aucoin, the director of the Urban Park Rangers, "the students were excited to participate in a real research study at Black Rock, the oak forest project."

Staff from the Natural Resources Group and the Urban Park Rangers are also involved in a citizen science project using salamanders as bio-indicators and hope to get other Consortium members interested in participating, both in the city and at the Forest.

"Being part of a consortium of organizations that are deeply interested in conservation issues is the greatest benefit of membership for us," explains Ms. Aucoin. "We are very excited about the possibilities of collaboration with other members as we pursue our goal of connecting New Yorkers to real nature right here in New York City."

"These two new members really add a lot to the Black Rock Forest Consortium," says Executive Director Dr. William Schuster. "The Hewitt School has outstanding teachers who are committed to using the Forest to enhance their curriculum. Their students arrive at the Forest fully open to learning while having fun at the same time. And the New York City Department of Parks and Recreation is an excellent organization with great land management, research, and education staff, who it is our great pleasure to work with. Their membership is helping Black Rock Forest become more valuable to New York City as a whole while adding a wealth of expertise and connections to a larger audience for the Consortium. We have exciting new programs planned with both organizations." ■

Student Research Spotlight: Oak Loss and Spiders

by Louise Lynch

Plant life is the bridge between the sun and organic energy, dictating the biodiversity of a habitat. Oak-dominated forests are a common habitat throughout the eastern United States, so many of our forest communities and their ecology are built on the dominance of oak species. However, factors including climate change, soil change, native and exotic diseases, and increasing deer populations are changing the composition of our forests. These changes, in turn, will likely cause changes in the diversity of forest invertebrate communities. Since May 2010, I have assisted Dr. Vladimir Ovtsharenko of the American Museum of Natural History in studying the invertebrate community of Black Rock Forest for the Future of Oak Forests project.

The study area consists of twenty 1.3-acre plots that have been treated to vary canopy tree composition. Project plots include controls (canopy composition untouched), plots with all oaks removed, plots with half of the oaks removed, and plots with all non-oak species removed Each plot also includes an area fenced to exclude deer and other large mammals.

While the invertebrate study includes the community as a whole, spiders are of special interest. As predators, spiders depend on the composition and quantity of prey organisms. Changes in their numbers and biodiversity would follow alterations in their prey, which in turn would follow changes in the prey's food sources and habitats caused by canopy changes.

I collected and combined three pitfall traps from each plot every 7 to 10 days. I sorted, counted, and identified all specimens to the level of class. Spider specimens will eventually be identified to the level of species. By comparing data collected in the treated plots to data from the control plots, it is possible to analyze the effect of changes in canopy composition on invertebrate populations.

Preliminary data show that the total mass of spiders more than doubled in the 100% oak-girdled plots and that abundance also increased, compared to the control plot. Additionally, a rapid decline in oak dominance has a greater effect in increasing spider biomass and abundance than a decline of non-oak species. ■

Louise Lynch is studying for a Masters of Science in entomology at the University of Nebraska-Lincoln. She worked with Dr. Vladimir Ovtsharenko of the American Museum of Natural History on the spider study portion of the Oak Forest Project.

Trout *(continued from page 1)*
remain in the larger stream segments and many streams are warmer than they were two centuries ago due to reduced tree cover. However, the many cold, clear headwater streams offer possibilities for brook trout restoration."

The Study

The study team included Forest staff and interns under the direction of Dr. Schuster and Dr. Wells, with key assistance from Forest Manager John Brady, Della Wells, and the DEC's Dustin Dominesey. Teams evaluated streams in Black Rock Forest, Bear Mountain, Sterling Forest, and Harriman State Parks, and West Point Military Academy through both their own research and collaboration with colleagues at these sites.

To assess habitat suitability, they recorded such stream characteristics as turbitity (trout need clear water to see prey), summer temperature, minimum late summer flow, and the presence or absence of cover, non-native fish species, and groundwater upswelling/deep pools suitable for spawning.

Teams also conducted fish surveys using a backpack-mounted electrofishing unit, focusing on streams in the Forest and in Storm King Clove, and also surveying streams in Harriman, Bear Mountain, and Sterling Forest State Parks in which native brook trout had been reported. They did some seine netting, since electrofishing is not the best method for catching smaller fish and thus assessing age distribution. There have been some previous genetic analyses indicating that some of these populations may represent genetically distinct strains.

The habitat evaluation confirmed that habitat for brook trout is limited in this region by low minimum summertime flows, areas with low tree cover and resultant warming of streams, drought (with many streams reported to run dry in summer), and the stocking of fishable streams with aggressive and invasive non-native fish. The team identified priority streams for further study: five that contained wild populations of brook trout (in Harriman and Bear Mountain) and four whose habitat is potentially conducive for species restoration (three in Black Rock Forest and one in Sterling Forest).

The study recommended further genetic analysis of the wild populations to answer the key question of whether the Hudson Highlands have wild strains of brook trout that have demonstrated survivability over long time periods. "If these wild strains still maintain their ancestral genetic heritage, they could be of high value to future restoration," says Dr. Schuster, "and these five streams should receive focus in conservation- or restoration-related work." Additional steps include enhancing habitat in the Forest and stream restoration elsewhere in the Highlands.

The Students

The de Coizart grant funded two college undergraduates to conduct the survey work outside the Forest. Supported by other funding, other students participated in related work, including students from the Urban Assembly for Applied Math and Science, students in the Consortium's summer High School Ecology Internship program, and high school students in a Columbia University program. A Barnard College environmental science major is assessing the four major Black Rock Forest streams using a GIS-based Habitat Suitability Index for her undergraduate thesis.

"Looking ahead," says Dr. Schuster, "students and adults from our member institutions will have opportunities to assist restoration initiatives through conservation internships and short-term projects." ■

AMS *(continued from page 1)*
made measurements, considered how to record their data in an organized way, drew pictures of plants and animals they observed, and began to think about what their data might mean. Back at AMS, they graphed their data and learned how to present their results in a scientific way.

"The kids loved the trip," Mr. Krulwich says, "and they learned more about how to think like a scientist by being outdoors doing something real than they would have following a list of lab procedures in a book. And some of the most valuable moments were unplanned — watching the fish, picking up a frog, seeing a snake, and trying to find a hiking trail in the pouring rain. These are the things they were talking about afterward."

The 10th grade earth science class visited the Forest to conclude its month-long unit on alternative energy, in which they learned about the formation and mining of fossil fuels, how power plants convert energy, and the pros and cons of fossil fuels, and then engaged in group research projects about alternative fuels.

"The trip up to Black Rock was a wonderful end to this unit," says teacher Annie Kushner. "Jack Caldwell explained several of the green features of the Science Center and Forest Lodge, including the heat pumps, the composting toilets, and the solar panels, and he also discussed the importance of local materials in the construction of the buildings. This added to what the students learned in this unit about fossil fuels, because they could see how a collection of green design features helps reduce a building's dependency on fossil fuels." The students also graphed solar panel data to analyze energy generation.

Other visits included an 11th grade earth science trip that gave students the opportunity to see how concepts they studied in class manifest themselves in the forest environment; a weekend visit in which 11th grade AP biology students took and graded mock AP exams to prepare for the real one; and overnight camping trips for fifth and tenth graders. The 10th grade trip is the culmination of an elective course on wilderness survival taught by principal Ken Baum. "This course provides a tremendous opportunity for individual student growth, and for student-student and staff-student bonding," notes Mr. Zavrel. "Building relationships with our students is a vital aspect of our school and plays a big role in our tremendous expected graduation rate."

Most AMS students come from the South Bronx and many are from disadvantaged families: 92% are entitled to a free lunch at school and the vast majority of the students' parents have not attended college, with some not finishing high school. But when AMS, a relatively new public school, graduates its first senior class this spring, some 90%+ of the students will graduate (the New York City average is around 60%), and most will attend college.

Sixth-grade students determine the acidity of pond water by adding an indicator dye and comparing the color of the sample to a palette of colors.

AMS also takes advantage of Black Rock Forest for student enrichment opportunities, particularly the Field Ecology Research Internship program in which 11 students have participated over the past three years. In her college application, Liza Morales, one of the early interns, wrote, "The Black Rock internship helped me deepen my love of science and inspired me to contribute to the scientific community" and "My experience taught me to be optimistic about work . . . I was able to exceed expectations. I now see no limits to my future."

"This experience has greatly motivated some of our top students to pursue further science enrichment programs and to study science in college," Mr. Zavrel says. "Five of our first six participants will likely earn a degree in biology and three are in selective programs where they conduct research or learn to do so, including the Summer Science Outreach Program at Rockefeller University, the Science Research Mentoring Program at the American Museum of Natural History, and Columbia's College of Physicians and Surgeons (this student will enter the Siemens Science Competition)."

Not only does AMS expect a high graduation rate, but its students demonstrate their desire to learn and excel in a variety of ways. Many participate in the summer botanical science program at Wave Hill, which includes college-level biology classes at Lehman College; one was selected as a Bezos Scholar and will be paired with a scientist at Rockefeller University to conduct research; two took a summer program at Harvard and one at the University of Michigan; one studied Arabic in Egypt for a month in the summer, and another studied the art and culture of China and Tibet; one hiked on a glacier in the Cascades with the Girls on Ice program; and several helped build schools in Nicaragua.

"Black Rock Forest provides multiple benefits for our school and our students," says Mr. Zavrel, "including the ability to study science in its natural context, the highly knowledgeable Forest staff, the teacher development programs which enable our teachers to discuss Forest use and lesson ideas with other Consortium teachers, a location for a staff retreat that builds our school community and positive attitudes, and the opportunity for students to appreciate the serenity and beauty of a real forest and the interconnectedness of living and non-living things in the Forest." ■

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. ■

Ecohydrologic Study of Plant Traits and Ecosystem Function. Matthew Palmer, Shahid Naeem, and Jessica Guo (Columbia University. *Contact: Matthew Palmer (mp2434 @ columbia.edu).*

Consequences of Oak Loss on Microbial Community Composition and Function. Krista L. McGuire (Barnard College). *Contact: kmcguire @ barnard.edu.*

The Future of Oak Forests. William Schuster (Black Rock Forest), Kevin Griffin (Lamont-Doherty Earth Observatory of Columbia University), Shahid Naeem (Columbia University), Kathleen Weathers (Cary Institute for Ecosystem Studies), and Jerry Melillo (The Ecosystems Center, Marine Biological Laboratory). *Contact: William Schuster (schuster @ blackrockforest.org).*

Population Dynamics of Painted Turtles in the Black Rock Forest. Christopher Raxworthy (American Museum of Natural History), William Schuster (Black Rock Forest), and Martha Villaba (Barnard College). *Contact: William Schuster (wschuster @ blackrockforest.org).*

Cycling of Mercury in Terrestrial Environments. Anthony Carpi (John Jay College, City University of New York) and Alan Frei (Hunter College, City University of New York). *Contact: Anthony Carpi (acarpi @ jjay.cuny.edu).*

Native Plant Performance along an Urbanization Gradient. Kevin Griffin and Natalie Boelman (Lamont-Doherty Earth Observatory), William Schuster (Black Rock Forest), Matthew Brown (Central Park Conservancy), and J. D. Lewis (Fordham University). *Contact: Kevin Griffin (griff @ ldeo.columbia.edu).*

Ecology of Slave-Maker Ants and Their Hosts: The Effect of Geographic Variation in Parasite and Host Range on Co-Evolutionary Trajectories. Christine A. Johnson (American Museum of Natural History). *Contact: cjohnson1 @ amnh.org.*

Functional Ecology of Complex Plastic Traits in Forest Trees: Pilot Studies of Reproductive and Root Traits. Hilary S. Callahan (Barnard College) and Louise Comas (Pennsylvania State University). *Contact: Hilary S. Callahan (hcallahan @ barnard.edu).*

The Carbon and Nitrogen Dynamics of Coarse Woody Debris in an Oak-Dominated Northern Forest. Matthew Palmer and Dan Flynn (Columbia University) and Kevin Griffin (Lamont-Doherty Earth Observatory, Columbia University). *Contact: Matthew Palmer (mp2434 @ columbia.edu).*

Linking Holocene Vegetation and Carbon Accumulation with Hydrological Change using Macrofossils, C/N, Stable Isotopes and Biomarkers from Sutherland Pond/Fen and Tamarack Pond. Dorothy Peteet (Lamont-Doherty Earth Observatory, Columbia University). *Contact: peteet @ ldeo. columbia.edu.*

Small Mammal Response to Oak Removal. Kate McFadden (Department of Ecology, Evolution and Environmental Biology, Columbia University). *Contact: kwm6 @ columbia.edu.*

Insect and Arachnid Diversity of Black Rock Forest. Vladimir I. Ovtsharenko (American Museum of Natural History). *Contact: ovtshare @ amnh.org).*

Total Below-Ground Carbon Budget in Black Rock Forest. Kevin Griffin and Jennifer Levy (Lamont-Doherty Earth Observatory, Columbia University. *Contact Kevin Griffin (griff @ ldeo.columbia.edu).*

An Assessment of the Effects of Girdling on Nitrogen Availability, Foliar Nitrogen Content, and Nitrogen Reduction of Forest Trees. Kevin Griffin (Lamont-Doherty Earth Observatory, Columbia University), Angie Patterson and Nancy Falxa-Raymond (Barnard College). *Contact: Kevin Griffin (griff @ ldeo.columbia.edu).* ■

On the Boardwalk!

After April, hikers on the White Oak Trail near Sphagnum Pond can thank the sixth grade at Metropolitan Montessori School for an easier and more ecologically sound journey. That's because the students, as part of a year-long project, are constructing a boardwalk that will keep hikers off the dam and out of the wetlands beneath it.

"This has always been a very marshy area for a large part of the year and most people crossed the dam instead," explains Jamie Kamlet, an educator who works with Metropolitan Montessori on its Black Rock Forest trips. "Forest Manager John Brady suggested that a boardwalk would make this small but vital section of trail attractive, and would also keep hikers from tramping over the fragile wetlands at the base of the dam or over the dam itself."

After the students helped cut down a tree, and John Brady milled it into planks and thicker pieces of wood, the students shaved the bark off the wood. They also dug out the muck around the stream below the dam and made sure that base planks were laid evenly. In April, they will return to the Forest to install the boards and build the boardwalk. They are also creating a station with information about and images of plants and animals found at the boardwalk site.

"This project connected with the students' work in the classroom," explains Metropolitan Montessori science teacher Jessica Fogel. "They've been learning about motion, forces, and structures. Specifically, they have been learning about the best designs for structures not only to be effective, but also to last over time."

Metropolitan Montessori sixth grade students have a tradition of a hands-on culminating project in the Forest. "This really requires the students to work as a team, both mentally and physically," Ms. Fogel adds. In past years, they have built a bridge, constructed trails, and put up bluebird nesting boxes, among other activities. Each time, they worked with their science teacher and with John Brady, who oversees all of the projects. ■

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Forest News in Brief

Small Grant Application Deadline February 15. The Consortium has announced its 22nd annual Small Grants program, generously funded by the Ernst Stiefel Foundation, with awards of up to $5000 for scientific research and up to $3000 for education projects conducted in Black Rock Forest. Partnerships between Consortium institutions are especially encouraged and may merit larger requests. Proposals are particularly solicited in five priority areas: projects that enhance the utility of the Forest's web site and contribute to the Consortium's Virtual Forest Initiative; research on forest ecosystem sustainability and response to disturbance; studies of plant and ecosystem function along urbanization gradients; research on the environmental impacts of recreation particularly (but not limited to) the impacts on trails; and production of educational materials related to alternative energy technologies. Guidelines and application materials are available on the Forest web site at www.blackrockforest.org/docs/scientist-resources/Small Grants/index.html. Applications are due February 15.

Educator Workshop March 4 and 5. Again in 2011, the Consortium is offering an in-service training program in the Forest. The program will (re)introduce educators to the Forest and its resources, review current curriculum offerings and trip programming ideas, describe the logistics of planning a trip to the Forest, introduce the Virtual Forest Initiative, review alternative energy materials, connect educators from different Consortium institutions, and create a sense of camaraderie. Educators may participate in both days, or one day only. Please contact Jack Caldwell for details.

High School Field Ecology Internship. For the fourth year, the Consortium will offer a two-week residential field ecology internship for high school students. The program will run from July 10 through July 22. Again led by Barnard professor Dr. Terryanne Maenza-Gmelch with teaching assistant Angelica Patterson, the program includes field study of key ecological concepts and investigative methodologies and gives students the opportunity to work directly with research scientists. Applications are due March 5. For more information, please visit www.blackrockforest.org/docs/teacher-student-resources/Field_Ecology_Research_Internship/index.html.

Member School Robotics Team Honored at White House. Two sixth grade students from The School at Columbia's competitive robotics team were selected by RoboCup Junior US to go to the first annual White House Science Fair and meet President Obama. "The honor belongs to all the members of RoboTeam who have worked so hard preparing for the national and international competitions over the past six years," says teacher Lisbeth Uribe, who coaches the team along with Amy Eguchi and Nikhat Ansari. "They worked countless weekends and afternoons perfecting their robots, programming, fields, sets and other elements that go into a winning performance of autonomous robots." In their school newspaper, the two sixth graders, Ben and Eve, wrote "The President's speech was very inspiring. He talked about how . . . it's important to recognize young scientists, as they are the future of this country." Congratulations to the team and their coaches! ■

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High School Ecology Internships
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Report from the Forest Manager

A great pulse of energy can be seen and felt in Black Rock Forest and surrounding regions. Acorns everywhere, of a magnitude seldom experienced. Only long-term memories remain of the previous bumper crop of twenty years ago. Acorns from a forest dominated by oak provide an occasional abundance that drives wildlife populations.

The energy flow to support the recovery of a humbled deer herd has arrived. White-tail body weight increased 10% in the fall of 2010 and the deer will be well fed over the winter, resulting in a successful fawning spring. Insects, birds, and rodents will share the crop, and all will display good health and reproduction. Later, predators of acorn-eaters will receive energy to supplement their own health and numbers. Some underground caches of acorns will become unattended when their collector is preyed upon, leading to germination and future trees.

Birds and other insect eaters also benefit. The nutritious acorn weevil has become exceedingly numerous, feeding on the meat of the acorns from the inside out; they, in turn, are sought out and eaten. Specific to red oaks, these weevils have claimed 44% of the 80,000 red oak acorns produced per acre.

In addition to the Forest-dominating black/red oak group, the white oak group fared just as well. Their thin-skinned acorns are preferred by wildlife for their nutrition and lack of bitter tannins. With little predation by insects (less than 10%), more than 70,000 acorns per acre were added to the mast crop.

The incredible combined total of 158,000 acorns (over 500 lb) per acre challenged the usual sampling methods for quantifying the mast crop. Determining hundreds of random plots for sampling and counting all the acorns soon became laborious and impractical, so an evaluation of individual trees was added. The sampling method measures the mass of acorns produced per acre, while the tree method rates individual performance by species and diameter class. After measuring production from more than 400 trees, an understanding of the crop size can be reached.

Oaks do not produce acorns on a regular cycle. In 2010, 63% of all oak trees between 10 and 30 inches in diameter produced acorns. In other good production years, only 40% of the oaks produced. At times, some trees have been huge producers. It has not been uncommon for oaks in the 20-in+ diameter class to produce more than 1000 acorns.

The explanation for such a remarkable mast occurrence for the most part is not known. Factors such as spring frosts and droughts impact annual production and cycles, but the control of the combined production of all species of oak to transfer so much natural energy to the forest floor is still an enigma.

The task of measuring such a large crop of acorns can be overwhelming. The help of classes of the Cornwall Elementary Schools in the collection, floating, counting and weighing of so many acorns was greatly appreciated. ■

— John Brady