# BLACK ROCK FOREST NEWS

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## Research on Future of Oak Forests Produces Early Results

This summer's work on the Consortium's Future of Oak Forest project produced important early results, involved more than a dozen scientists and students, and set the stage for future studies and analyses. The multiyear, multi-investigator research is the first direct, manipulative investigation of the cascades of impacts likely to follow the loss of oaks, in advance of what may occur should they succumb to current and/or future threats (see "Oak Project Update," Spring 2008). As foundation species in northeastern forests, oaks play vital roles in the ecosystem, affecting water yield and quality, carbon storage, fire regimes, and biological diversity.

**Hannah Roth, a former Research Associate at the Forest, using a lysimeter to collect water that percolates through the soil into streams and groundwater so its chemistry can be analyzed to study nutrient cycling and possible water degradation.**

New researchers also worked on the project this year, including Dr. Krista McGuire of Barnard College, a microbial ecologist, and Dr. Matthew Palmer of Columbia University, a plant ecologist. They joined principal investigators from Columbia's departments of Earth and Environmental Science and of Ecology, Evolution, and Environmental Biology (E3B), the Ecosystems Center of the Marine Biological Laboratory, the American Museum of Natural History, the Cary Institute for Environmental Studies, Harvard University, and Fordham University's Calder Ecological Center, as well as the Forest itself. Their work was supplemented by undergraduate and graduate students, and even high school students participating in the summer research internship program.

Since early 2009, Katie Pavlis, who recently received her masters in Conservation Biology from Columbia University, has been the Consortium's Research Associate/Environmental Educator. She coordinates all the research activities for the oak forest project, including data management and communications among the individuals and groups from different institutions who are working on it. She works with Dr. Schuster on soil and water analyses and tree responses and manages the efforts of Forest staff members working on the project, including annual tree measurements, periodic litterfall collection, sample processing, deer tick surveys, and other activities. John Brady, Black Rock's Forest Manager, is in charge of the deer exclosures and tree girdling, and Data Manger Matthew Munson takes care of nitrogen sampling and environmental monitoring.

Initial funding from the Ogden, Phipps, Monell, J & AR, and Golden Family foundations allowed the Consortium to establish a series of study plots on the Forest's north slope and

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## Restoring Brook Trout

### *Stream Surveys and Habitat Work*

Over last summer and fall, Consortium staff members and aquatic biologist Dr. Alan Wells, surveyed the four stream drainages in Black Rock Forest for brook trout (*Salvelinus fontinalis*). The surveys were part of a project to create a restoration plan for brook trout in the Hudson Highlands region, generously funded by the Sarah K. de Coizart TENTH Perpetual Charitable Trust. This grant enables the Consortium to become more deeply involved in trout conservation, restore habitats, and engage with others working on the issue. This spring and summer, high school, undergraduate, and graduate students can also participate in the project.

Populations of brook trout, the New York state fish, have declined dramatically, largely due to human-caused habitat deterioration, as they require water that is clean and cold, and to predation by non-native brown trout (*Salmo trutta*). Since 2001, the Consortium has grown brook trout from eggs and released them into the Forest's streams, creating educational opportunities for hundreds of students through the Brookies at Black Rock project developed by Forest Manager John Brady. This past spring, with funds from the New York State Senate granted by the state's Office of Parks, Recreation and Historic Preservation (thanks to the help of State Senator William Larkin) and from the Hudson River Improvement Fund, the Consortium turned the unfinished basement of the Forest Lodge into an aquatic laboratory, the Hatchery (see "Renovated Hatchery Enhances Trout Conservation, Learning," Spring 2009).

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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.

The Consortium is a not-for-profit 501(c)(3) organization supported by membership dues, grants, and gifts.

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Barnard College
The Browning School
The Calhoun School
Central Park Conservancy
Columbia University
Cornwall Central School District
The Dalton School
Hunter College
Marine Biological Laboratory at Woods Hole—The Ecosystems Center
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*Black Rock Forest News*
Sibyl R. Golden, Editor


# Report from the Executive Director

Stewards of land, and scientists who study nature, need to know how their area of study compares and contrasts with surrounding ecosystems. How does Black Rock Forest compare to its surroundings? The United States Forest Service's nationwide Forest Inventory and Analysis (FIA) database provides a rich source for answering such questions. I used FIA data to compare forest characteristics in Black Rock Forest to those in the Highlands Regional Study Area, which stretches from Harrisburg, Pennsylvania, through northern New Jersey and southeastern New York into western Connecticut. There are more than 500 FIA study plots within this boundary.

The most obvious pattern is that the proportion of forested area is twice as great in the northern Highlands as in the south. The dividing line is Interstate 80, constructed roughly along the terminal reach of the Pleistocene glaciers. The unglaciated Highlands are more weathered and less steep, on average, than the northern Highlands. This gentler landscape was more heavily used and developed (only 35% remains in forest) and stands tend to be small and fragmented. Black Rock is about 95% forested; the northern Highlands are on average 70% forested. Small forest patches often lack attributes of larger forests and may not provide as many ecosystem services.

Highlands forests are dominated by oaks, but valley areas have more maple, tulip poplar, and other tree species. Northernmost Highlands forests feature hardwoods like sugar maple and beech, with hemlock and white pine, while these species may be rare or absent in southern Highlands forests. Black Rock is decidedly oak-dominated, with some northern hardwoods and hemlocks on north-facing slopes. Its species composition is most similar to Highlands forests in New York, northernmost New Jersey, and the Taconics in Connecticut.

Stand age varies from very young to about 150 years. Southern Highlands forests are younger on average by 10 years, but most Highlands forests fall in a range of 60 to 100 years old. Thus, there is an overabundance of mid-successional forests, with few early- and almost no late-successional forests. In Black Rock, most stands are nearly 25 years older, averaging 85 to 125 years, still mid-successional but ecologically "more mature," with higher total biomass.

Populations of large vertebrates, top carnivores, and other organisms with extensive habitat requirements have been reduced or eliminated through much of the Highlands. But some larger and less fragmented forests have more extensive food webs and retain top carnivores. Black Rock is characteristic of larger forested areas where coyotes and bears range, along with raptors, otters, and other animals with large home ranges.

Forest productivity, in terms of biomass produced per year, is nearly 25% higher in the southern Highlands compared to Black Rock and the average for the northern Highlands. But site fertility and productivity also vary widely, being generally higher in valleys than on slopes and ridges. Nutrients are especially difficult to obtain in mountain areas with thin soils, acidified by acid precipitation. In some areas with calcium-containing soils, forest productivity can be quite high. But most of these areas were long ago converted to agriculture and other uses.

Forest acidification is one of a suite of challenges to Highlands forest health and sustainability, along with displacement of natives by exotics, mortality from pests and pathogens, excessive herbivory, regeneration failure, fire suppression, habitat alteration, and changing climate. The relative severity of these factors differs around the region, and none act in isolation. In Black Rock, we need not be concerned about development, but with canopy tree mortality, regeneration failure, and influxes of exotic species, we are concerned about the nature of the future forest.

This knowledge can help in interpreting research results and placing them in broader context. It may help us better understand the regional ecosystem and deduce what future changes and flows of organisms, energy, and nutrients we can expect. Seeing the whole forest, and not just the local trees, should help us better understand, and more responsibly manage, our ecosystems. ■

*— Dr. William Schuster*

# Rain Garden Captures Runoff, Improves Water Quality

Thanks to Black Rock Forest's new "rain garden," runoff from its parking lot and driveways is now helping to grow plants and recharge the groundwater, filtering out sediment and pollutants rather than sending them, along with the water, directly into the Forest's streams. "We installed our rain garden to help protect the quality of our Forest streams and also as a demonstration project to encourage others to install rain gardens in the future," explained Consortium Executive Director Dr. William Schuster. The rain garden joins the Forest's green building and energy features, including solar panels, geothermal heating and cooling, and possible microhydro and wind energy demonstration projects (see "Forest Develops Renewable Energy Options," Winter 2008).

The rain garden was truly a collaborative project. With funding provided by the New York State Environmental Protection Fund, through the state Department of Environmental Conservation and the Hudson River Estuary Program, Consortium staff worked closely with Simon Gruber, a local environmental consultant; Kevin Sumner, from the Orange County Soil and Water Conservation District, a leader in the design and installation of rain gardens, who designed the rain garden; and Lucy Joyce and Rose Baglia from the Cornell Cooperative Extension. Forest staff constructed the garden over the summer with guidance from Kevin Sumner, and then planted it with help from volunteers and Mr. Sumner and Mr. Gruber.

**The rain garden under construction, with Katie Pavlis, Bill Schuster, and Kevin Sumner.**

Plants for rain gardens must have wide soil tolerance and deer resistance. To create a natural appearance, the garden was broadcast-seeded with grass and wildflower seeds, including New England aster, snowberry, white dogwood, shadblow, coreopsis, winterberry, nine bark, soft rush, tussock sedge, and witch hazel. The garden has a landscaping fabric underneath and a natural stone mulch.

Dr. Schuster and Mr. Gruber will demonstrate the rain garden on May 1 at 10 AM. ■

# Forest Acquires Misdom House on Reservoir Road

The red wood house just outside the entrance to Black Rock Forest on Reservoir Road now belongs to the Forest! Known as the Misdom House after the family that owned it for generations, it will serve both as a caretaker's house and as lodging for longer-term visitors to the Forest, including researchers and graduate students.

The last owner of the house, Helen Misdom Johnson, was a friend of Black Rock Forest and often expressed an interest in seeing the house go to the Forest. After she died, her executor offered it to the Black Rock Forest Preserve, which owns the Forest and leases it to the Consortium, and the sale was concluded in the fall of 2009

The house includes a kitchen with a small eating area, a large living room with a fireplace, a combination den/library/television room, three bedrooms, and three full bathrooms. The rooms are arranged so that two separate stairways lead to two separate upstairs spaces, which will make it possible for a caretaker to live in the house while adult guests stay in another part, sharing the kitchen but having separate sleeping areas.

For the first year or so, Forest Manager John Brady and Office Manager Barbara Brady are living in the house as caretakers and are gradually fixing it up to make it comfortable for future guests.

"It is wonderful to have this special property as an official part of the Forest," says Consortium Executive Director Dr. William Schuster. "It provides us with a "gatehouse" at our entrance, and guest lodgers will enjoy easy walking access into the Forest." ■

# Student Research Spotlight: Impacts of Invasive Shrubs

*by Aimee Kemp*

Invasive species are transforming native ecosystems all over the world. In the northeast, the invasive shrub Japanese barberry (*Berberis thunbergii*) has spread from gardens into native forest ecosystems. Last summer, I looked at how both barberry and exotic earthworms are affecting salamander populations and leaf litter communities in deciduous forests. I worked in the Forest under the guidance of Dr. Matthew Palmer in Columbia's Department of Ecology, Evolution, and Environmental Biology.

Salamanders are key components of forest ecosystems. They are top-down regulators of arthropod and other leaf litter invertebrate populations and provide food for predators such as birds, snakes, raccoons, and bears. Declines in salamander populations could have dramatic effects on native forest food webs.

I compared sites dominated by native vegetation with sites dominated by barberry. I measured an array of environmental factors including soil pH, soil depth, soil organic content, and leaf litter depth. I measured arthropod abundance and diversity in leaf litter samples. I estimated earthworm abundance by pouring a dilute solution of dissolved mustard over a small patch of soil, which caused the earthworms to wriggle to the surface where I could count them. I collected data on salamander abundance using a photographic record to identify individuals, measuring, photographing, and releasing them. Salamander searches took place after rain, when they are most active.

My results showed that barberry-dominated sites had higher soil pH, thinner leaf litter layers, shallower soils, and less organic content than sites dominated by native vegetation. Barberry sites also had significantly lower abundances of salamanders, arthropods, and earthworms.

I found 85 individual salamanders: 64 in sites dominated by native vegetation and 21 in sites dominated by barberry. The most frequently found species, the eastern red-back salamander (*Plethodon cinereus*), accounted for 54% of the total. Red-back salamanders found in barberry sites were significantly smaller (average 18.9 mm) than those found in native sites (average 38.9 mm).

My results help us understand how invasives like Japanese barberry are affecting native ecosystems. Getting a better sense of their extensive impacts highlights the need to implement management plans. In slowing, or perhaps even stopping, the spread of barberry and other invasives, we will be better positioned to preserve native biodiversity in Black Rock Forest and the rest of the northeast. ■

*Aimee Kemp is a senior majoring in environmental biology at Columbia.*

**Trout** *(continued from page 1)*

## Restoration

The first step in evaluating the possibility of restoring the brook trout is to determine its current status in Black Rock Forest and around the Hudson Highlands. Staff members worked with Dr. Wells and Dustin Dominesey of the New York State Department of Environmental Conservation to identify the number and species of all fish in Black Rock Brook, Cascade Brook, Canterbury Brook, and Mineral Springs. "We found brook trout in all four," says Katie Pavlis, Research Associate/Environmental Educator. "Many were small fingerlings, most likely released by the Brookies at Black Rock program, but we also found at least one adult, some in full spawning color, in each stream."

Forest Manager John Brady, with school groups and volunteers, has worked on the habitat restoration aspect of the project, planting native conifers such as white pine (*Pinus strobus*) along stream banks to help maintain the cool water temperatures required for brook trout survival.

In the fall, Ms. Pavlis, Emily. Cunningham, the Consortium's development director, and Mr. Brady participated in the annual meeting of the Eastern Brook Trout Joint Venture, a partnership of public and private organizations working to stop brook trout decline and restore fishable populations. They gained a broader perspective on other efforts throughout the species range.

## Student Opportunities

Starting in the spring of 2010, the Consortium will create a variety of opportunities for students. "We need to conduct more population surveys," explains Ms. Pavlis, "to determine the survival rate of our introductions and get more data about breeding status and the stream community."

Specifically, the Consortium will offer summer internships, with stipends of $400 per week plus lodging, for undergraduate and graduate students who will gather data on biotic and abiotic factors to create a habitat suitability index using guidelines developed by Trout Unlimited. More information is online at www.blackrockforest.org/docs/teacher-student-resources/2010PostSecondaryInternships/index.html.

The Consortium would also like to find a graduate student to perform genetic analyses on trout populations in the Forest and possibly elsewhere; the Small Grants program (see "Forest News in Brief," p. 7) might provide funding. Finally, the Consortium hopes to involve high school students in habitat restoration and other projects. Interested students and teachers should contact Ms. Pavlis at the Forest. ■

**Dustin Dominesey from the DEC, Dr. Alan Wells, Jack Caldwell, and Katie Pavlis surveying stream.**

**Oak Forests** *(continued from page 1)*
to survey the plots to determine baseline data on flora, fauna, soil, and environmental variables before they were subjected to treatments. The treatments created three plots in which all the oaks were girdled (to mimic sudden oak death), three with half the oaks girdled, three with all non-oaks girdled, and three that serve as unmanipulated controls; each plot also contains a subplot fenced to exclude deer. Now that the treatments have been in effect for 18 months, researchers are able to determine their initial impact on tree species composition and live above-ground biomass, understory vegetation, coarse woody debris, environmental variables (such as water, temperature, and light), soil respiration, decomposition, nitrogen dynamics, soil water chemistry, mycorrhizal fungi, small mammals, and spiders, ants, ticks, and litter insects.

## Key Results

"Some of our most exciting early results come from the soil respiration work pursued by Jen Levy, a doctoral student working with Dr. Kevin Griffin from the Lamont-Doherty Earth Observatory," says Consortium Executive Director Dr. William Schuster. "It demonstrates that the below-ground respiratory response to tree loss is nonlinear, which suggests that there may be a critical threshold of canopy tree loss beyond which major ecosystem functions break down." The researchers are now teaming up with other scientists to test the hypothesis that the below-ground fungal—tree root network is sustained up to a certain level of tree loss, but collapses at higher levels of damage.

The project also looks beyond the research being conducted at the Forest. The Black Rock team is now officially collaborating with a Harvard Forest group that experimentally girdled hemlocks in 2005, and thus aims to produce a comparative analysis of the results. The Harvard Forest team is also investigating recent widespread loss of canopy oak trees in southeastern Massachusetts; substantial oak tree loss has also been experienced in the past year in several counties in central Pennsylvania. "My survey of US Forest Service data from stands across the Hudson Highlands has shown recent oak mortality similar to what we are seeing here in Black Rock," says Dr. Schuster. "The results of our research may thus soon be of more than academic interest."

**Fresh oak leaves are placed in decomposition bags under the leaf litter so scientists can look for changes in decomposition rates that may result from treatments.**

## Other Activities

Barnard microbial ecologist Dr. McGuire and postdoctoral associate Dr. Ilka Djukic are using a variety of techniques to assess soil microbial population composition and diversity, and to quantify the effects of the treatments on these communities. Along with the ongoing mycorrhizal fungal research of Dr. J. D. Lewis and Dr. Amy Tuininga of Fordham University, their work will help scientists understand the below-ground dynamics that underlie the organismal and ecosystem responses to canopy tree disturbance.

Columbia's Dr. Palmer, with a team of assistants, has tagged more than 3000 tree seedlings in the study area so he can carry out a long-term demographic study of them. He has also taken over the analyses of understory plants inside and outside the deer exclosure areas within each plot.

Dr. Griffin, who has been working on the project since its beginning, has begun investigating changes in the operating physiology of trees in response to the treatments, focusing initially on the leaf-level activity of a key enzyme (nitrate reductase), along with Dr. Schuster and visiting researcher Dr. Matthew Turnbull from the University of Canterbury in New Zealand. Working with students from an ecophysiology class, he demonstrated that the ubiquitous shrub witch hazel (*Hamamelis virginiana*) exhibits significant changes in photosynthesis, flowering, enzyme activity, and other factors in response to the oak-girdling treatments.

A major summer effort involved accurately mapping each study plot, in three dimensions, including the coordinates of all the oak trees in the project area and all non-oaks in the central part of each plot. For each tree, the extent of its canopy and its sprouting response (or lack thereof) to the girdling treatment was recorded. These data will facilitate spatial analysis of the researchers' results and will enable Dr. Maria Uriarte of Columbia University to conduct long-term modeling efforts. These geographic representations of forest stands are also being used for the Consortium's Virtual Forest Initiative which will give students online access to the Forest's rich archive of scientific data and to carefully designed education modules (see "Virtual Forest Initiative," Winter 2009).

Dr. Aaron Ellison from Harvard Forest returned to continue his study of the impact of oak loss on ant communities, Dr. Vladimir Ovtsharenko from the American Museum of Natural History continued his study of spiders (see "Small Grants," Spring 2005), and Sharon Newman, a Columbia graduate student, continued her study of small mammals in the study plots (see "Summer Students," Fall 2009).

## Next Steps

Over the next year, scientists will compile their results to quantify the initial impacts of the treatments, both with and without deer browsing. They will also conduct more detailed analyses of the implications of oak tree loss for water quality and Lyme disease prevalence, and will compare their results to those from foundation taxon experiments at Harvard Forest and elsewhere. Beyond that, they plan to continue collecting and analyzing data for 5 to 10 years past the initial treatment and to use modeling to understand long-term responses. "This study, along with others like it, will help us better understand the crucial roles played by foundation species in our forests and indicate how we should manage our changing forests to minimize the adverse effects of change," notes Dr. Schuster. ■

# 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. ■

**Distribution, Assemblage, and Activity of Bats in a Temperate Urban Landscape.** Chanda Bennett (American Museum of Natural History. *Contact: bennett @ amnh.org.*

**Oak 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 (schuster @ ldeo.columbia.edu).*

**Cycling of Mercury in Terrestrial Environments.** Allan Frei (Hunter College, City University of New York), Anthony Carpi (John Jay College, City University of New York), David Evers (Biodiversity Research Institute), and Roger Claybrook (US Mercury Deposition Network). *Contact Anthony Carpi (acarpi @ jjay.cuny.edu).*

**Reproductive Effects of Mercury in Red-Winged Blackbirds (*Agelaius phoeniceus*) Breeding in the New York Metropolitan Area.** Christine Sheppard (Wildlife Conservation Society) and Shahid Naaem (Columbia University). *Contact: Christine Sheppard (csheppard @ wcs.org).*

**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 Autotrophic Contribution to Soil Respiration by *Quercus* and Its Associated Mycorrhizal Fungi in Black Rock Forest: An Assessment for the Ecosystem Consequence of Foundation Taxon Loss Project.** Kevin Griffin (Lamont-Doherty Earth Observatory*). Contact: griff @ ldeo.columbia.edu*

**Land-Atmosphere Coupling at Black Rock Forest: The Role of Snow, Vegetation, and Soil Thermodynamics.** Gavin Gong (Department of Earth and Environmental Engineering, Columbia University), Jason Smerdon (Lamont-Doherty Earth Observatory), and Jessie Cherry (University of Alaska). *Contact: Jason Smerdon (jsmerdon @ ldeo.columbia.edu).*

**Effects of Host Defoliation and Distribution on Spatial Patterns in Ectomycorrhizal Fungi.** J. D. Lewis (Fordham University). *Contact: jdlewis @ fordham.edu.*

**The Tamarack Pond Core as a Rosetta Stone for Impact Events: Correlation to Known Ejecta Layers.** Dallas Abbott (Lamont-Doherty Earth Observatory). *Contact: dallas @ ldeo.columbia.edu.*

**Long-Term Study (78+ years) of Tree Population Dynamics and Carbon Storage.** William Schuster (Black Rock Forest). *Contact: schuster @ ldeo.columbia.edu.*

**Small Mammal Response to Oak Removal.** Jenna Lawrence and Kate McFadden (Department of Ecology, Evolution and Environmental Biology, Columbia University). *Contact: Jenna Lawrence (jml126 @ columbia.edu).*

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

# *Curricula on Web!*

Over the years, Forest staff and teachers from Consortium member institutions have developed a wealth of lesson plans, activities, and curricula for students of all ages. This collaborative effort has produced curricula that can be adapted and used by teachers from other Consortium schools. Some of the contributors who created curricula for Black Rock Forest are Terry Murray, teachers from the Dalton School, Americorps members, and most of the Forest staff.

Available curricula span the life sciences, earth science, math, green technology, chemistry, physics, visual arts, social studies, and creative writing, and are broken down by age/grade level as well. For example, within the life sciences, curricula include freshwater environments for grades 4-12, dendochronology for grades 6-8, and tree ring classes, including coring, for high school students and college undergraduates.

Within math and technology, classes include map and compass for grades 4-8, forest mensuration for grades 4-12, and GPS lessons for grades 6-12 and undergraduates. Other examples include examining rock samples from Black Rock Forest for grades 4-12 and studying the glacial erratic on White Rock Road, also for grades 4-12 (for earth science), as well as the Habitats of Black Rock Forest series, which covers a wide range of topics from life science to earth science, including human impact and Forest history, for grades 4-12.

In an effort to make these materials more widely available, the Consortium is in the process of adding them to its web site. Through a password-protected page, these curricula will be available only to Consortium member institutions, not to the general web audience. This members-only section of the web site will be accessible from the current Curriculum page, www.blackrockforest.org/docs/teacher-student-resources/EducationalResources/Curricula.html; member institutions will be provided with the password once the new section is set up. ■

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## *Forest News in Brief*

**Small Grants Deadline February 1.** The Consortium has announced its 21st 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. Up to $8000 may be awarded for research/education partnerships between two member institutions. Proposals are particularly solicited in five priority areas: production of educational materials related to alternative energy technologies; 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. Guidelines and application materials are available on Black Rock's web site at www.blackrockforest.org/docs/scientist-resources/SmallGrants/index.html. The application deadline is February 1.

**Teacher Workshop February 26 & 27.** Again in 2010, the Consortium is offering an in-service training program in the Forest. The program will (re)introduce teachers 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, and connect teachers from different Consortium schools and create a sense of camaraderie. Teachers may participate in both days, or Friday only. For more information, please contact Jack Caldwell at the Forest.

**High School Field Ecology Internship**. For the third year, the Consortium will offer a two-week residential field ecology internship for high school students. 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.

**Consortium Awarded Toyota Education Grant.** The Consortium is thrilled to have been awarded a three-year, $500,000 grant from the Toyota USA Foundation for its Virtual Forest Partnership. The grant will allow the Consortium to hire its first director of education in early 2010, work with the Columbia Center for New Media Teaching and Learning to develop middle– and high-school modules for the Virtual Forest Initiative that will be made available to all Consortium schools, and work with eight New York City public schools serving economically disadvantaged minority students.

**Parks Department Joins Consortium.** The Consortium is delighted to welcome the New York City Department of Parks and Recreation as its newest member. The Department hopes to work with Black Rock on forestry and education initiatives. Welcome! ■

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***Small Grant Applications Due Feb. 1***
***See p. 7***

## *Inside This Issue*



## *Report from the Forest Manager*

An interesting research opportunity has developed in the Village of Cornwall-on-Hudson. Whitetail deer have become overabundant and Village citizens were concerned about their impacts on manicured landscapes, forest regeneration, and human health and safety. A Citizens Task Force proposed a fall bow hunt, with the potential to yield biological data on the deer population.

This interested Barnard College student Laura Diefenbach, who wanted to analyze the population and the effectiveness of hunting as a control measure. Comparisons could be made between deer populations in the Village and Black Rock Forest, which have similar topography and soils but are divided by Route 9W. The Forest has had a hunting heritage for over a century, while the Village has had no deer control aside from fencing.

Laura began her study last winter, supported by Forest staff, by assessing deer density. Before fawns were born in the spring, Village density estimates averaged 79 deer per square mile compared to 28 in the Forest. New fenced exclosures were then constructed, excluding deer from study plots in the Village. Forest regeneration and species composition will be compared over time with exclosures in Black Rock Forest.

In December, after a successful and safe bow hunt, biology data collection began. Thirty-four deer were harvested: 26 does and 8 bucks, approximately 20% of the herd. They were measured for body weight, antler diameter, and teat length. Measurements were grouped to analyze health by age class and sex.

The youngest deer taken in the Village had body weights below 50 lb, dangerously low for surviving the winter. Males aged 16-18 months averaged 75 lb, compared to 90 lb in the Forest, indicating the Village deer are not reaching their yearling potential. Antler diameter 1 inch above the base ranged from 14 to 17 mm at Black Rock, but Village yearlings did not have enough antler growth to measure. Yearling antler development is largely a function of diet. A growing body uses calcium and other minerals first; antler growth is secondary. The lack of antlers indicates probable lack of adequate nutrition. The four yearling females mirrored the males with low body weights of 56-74 lb, and had no signs of reproduction.

The physical state of the nine 2.5-year-old females reinforced the yearling evaluation: only two had teats over 10 mm, indicating suckling of young. But they did show reproductive potential, with average weights of 85 lb. The remaining eleven adult does were up to 9.5 years old, and all were of good weight and reproducing.

In conclusion, the data demonstrated high reproductive potential for females between 2.5 and 6.5 years. But fawns and yearlings showed signs of physical and social stress, suggesting deteriorated habitat which may eventually compound the herd's difficulties by affecting the timing of breeding and birthing seasons. Two yearlings had skin tumors, sometimes called "warts," that are specific to deer and are considered no threat to human health.

Ms Diefenbach and Forest staff will continue this study and evaluate hunting as a control method, ■

*— John Brady*