

Brief Descriptions of Black Rock Forest Curricula

High School Level: Ninth Grade to Twelfth Grade

These brief descriptions of curricula frequently pursued by high school grades at Black Rock Forest are organized by subject area. Consortium members may obtain information and curriculum materials from Forest staff. Descriptions of curricula for other grade levels are also available on this web site.

Life Science

Aquatic Invertebrates. A stream's condition and health can be evaluated by determining the amount and types of aquatic invertebrates living in it. Students sample streams to collect a selection of the invertebrates. Then they identify the organisms and assess the condition of the stream by constructing indices such as the EPT and Biotic Index. This information can be combined with water chemistry and physical measurements to provide a full stream assessment.

Biodiversity. In this hands-on class, students quantify and compare the woody plant diversity of two or more Forest plots with different historical land uses. Students calculate and compare species richness and the relative abundance of woody tree species and draw conclusions about the relationships between land use and biodiversity.

Dendrology. Students can learn to distinguish woody plant species using leaf and bark characteristics in concert with a dichotomous key. They can then test their skills on a test course with numbered trees. Teachers can adjust this course to accommodate the difficulty level that is needed for their students. For example, a more challenging activity can be pursued in late fall through early spring, keying out species using only bark, twig and bud characteristics.

Forest Ecosystems. *This is an interdisciplinary unit with separate write-ups for plant life, wildlife, geology and soils, human impacts, and environmental measurements, which can be pursued together or separately.* A hike leading from the Center for Science and Education to the White Oak Tree includes ten stops, each representing a different habitat found in the Forest. At each stop, Forest staff have collected information about wildlife, plant life, geology and soils, environmental measurements, and human impacts. The theme or themes of the hike can be chosen by an instructor based on the class level and interest. That theme can then be continued through the hike. Generally, the wildlife and plant life classes are suggested for younger grades and the others are for more advanced classes. The time needed to complete each class is about 3-4 hours.

Mammals. Introduction to the mammals of Black Rock begins with a discussion of mammal adaptations using skulls, skins, and pictures. The diverse habitats of mammals can also be discussed. Following the lab discussion, it is off to the woods to investigate animal signs and survival strategies in a variety of habitats.

Ornithology. Black Rock Forest has a complete Forest bird list, binoculars, field guides, and audio learning tapes to assist teachers and their students with this very popular field study. Peak times for study are spring warbler migrations (April-May), fall migrations (September-October), and winter bald eagle observation (December-March). Students can closely observe birds at feeding stations located at the Center for Science and Education and at the Stone House.

Turtles. Black Rock Forest is home to a variety of aquatic and terrestrial turtles. Years of study of aquatic painted and snapping turtles have produced much information pertaining to behavior, population size, sex ratio, and age structure. Turtles with electronic tags can be sampled with basking and baited hoop traps. Students can then scan them for tags and weigh, measure, and identify the sex of the turtles. In the classroom, students can examine historical turtle data and then use their own data to estimate population size (mark-recapture) and other parameters.

Watershed Exploration. Students learn that high-quality surface water is a rare and vital resource that needs to be protected, and that plants and animals, human use, and land use all impact the quality of our water. The water cycle is discussed, emphasizing the movement of water between the earth and atmosphere.

Wetlands. Students learn that wetlands provide many benefits to humans and animals. They also learn the conditions that characterize a wetland. Students can document wetland plant species by observing species composition on a transect and then comparing it to that of adjacent uplands, and can view and discuss their adaptations. They can examine characteristics of wetland soils, including field capacity, organic matter content, and mottling. Characteristic wetland animals can also be studied.

Earth Science

Forest Ecosystems. *This is an interdisciplinary unit with separate write-ups for plant life, wildlife, geology and soils, human impacts, and environmental measurements, which can be pursued together or separately.* A hike leading from the Center for Science and Education to the White Oak Tree includes ten stops, each representing a different habitat found in the Forest. At each stop, Forest staff have collected information about wildlife, plant life, geology and soils, environmental measurements, and human impacts. The theme or themes of the hike can be chosen by an instructor based on the class level and interest. That theme can then continued through the hike. Generally, the wildlife and plant life classes are suggested for younger grades and the others are for more advanced classes. The time needed to complete each class is about 3-4 hours.

Geology and Soils. Evidence of earth processes can be productively studied in natural forest settings. Students can examine specimens of igneous, sedimentary, and metamorphic rocks by eye and under a lens and test them to determine mineral composition. The genesis of the bedrock, 1+-billion-year-old granite gneiss, is described in materials prepared by curators from the American Museum of Natural History's Department of Earth and Planetary Sciences. Polished hand samples can be examined. Classes can also study Pleistocene and Recent changes to the geology and topography, including glacial erratics and deep glacial till deposits. They can examine comparative soil pits to discover how different soils have developed in different locations, substantially impacting community type and productivity.

Glaciers and Erosion. Pleistocene glaciers covered the northeast for most of the last several million years. Students can view many different types of physical evidence in the field, including large erratic boulders, deposits of glacial till, and evidence of glacial scouring. Since glacial retreat, erosion has been a major force shaping the landscape, continuing up to this day. Students can easily observe evidence of wind and water erosion and downslope movement of materials, as well as deposition and accumulation of sediments in ponds and low-lying areas. They can estimate sedimentation rates from sediment depth measurements.

Orienteering. Students learn how to properly use a compass and a map to orient themselves in the Forest. After an introduction to the compass and learning how to measure distances by pacing, students set off in small groups to complete a compass course. Two compass courses have been set up: one at the Stone House and one at the Center for Science and Education.

Rocks and Minerals. With its shallow soil and rocky terrain, Black Rock Forest is ideal for studying rocks and minerals. One of the best areas for this is the rock slide on the south side of Mt. Misery. The majority of the rocks found in Black Rock Forest are metamorphic, though many sedimentary rocks were deposited by glaciers. Hand samples of various rocks from the Forest in which various minerals can be identified have been cut and polished by scientists from the American Museum of Natural History.

Weather and Climate. Black Rock Forest's weather records date back to 1959, and air temperature and precipitation records from a nearby station at the US Military Academy at West Point date back to the early 1800s. Many of these data are available online and students can analyze them to examine long-term change and, by viewing them along with other long-term records, can compare, for example, New York City's weather to that of the Forest. Classes can visit Black Rock's remote, automated environmental monitoring stations to see digital sensors, dataloggers, and radiotelemetry equipment used in modern climate stations. Online tools and digital exercises have been developed to allow students to explore data sets and visualize relationships among different climate variables.

Hydrology. The hydrologic cycle can be studied in detail in natural watersheds. Black Rock's weather stations provide accurate data on precipitation (P) inputs. Students can directly estimate stream discharge (D) from field measurements (flow, cross-sectional area), convert these to seasonal estimates, and compare them to the Forest's stream gauge records. Assuming a zero change in storage, actual annual evapotranspiration (ET) can be estimated as $P - D$. Classes can make field visits to examine the construction and operation of a stream gauge station and associated meteorological stations; online data sets are available for analysis. A dedicated 400-foot deep well can be used to study groundwater depth, chemistry, etc.

Chemistry

Surface Water Testing. Students measure pH, dissolved oxygen, and temperature along an elevational gradient from Tamarack Pond (elevation 1305 feet) to Aleck Meadow Reservoir (elevation 1016 feet), stopping four times. These trips can be extended if time allows down to the Hudson River at sea level. Through their observations, students develop an understanding of natural water filtration and its impacts on plant and animal life, including human populations.

Physics

Environmental Measurement. The Black Rock Forest Consortium has installed an environmental monitoring network in the Forest, consisting of a series of remote, automated environmental monitoring stations that measure weather conditions, soil and stream conditions, and other environmental parameters. Classes can tour these stations to learn how research-grade environmental data are collected. They can then access archived and real-time data from the network and explore them using a series of digital exercises.

Math and Technology

Forest Mensuration. Determining the wood volume in a forest tree or stand, the value of a woodlot, and the amount of wood materials used in construction of a building are all real-world mathematical exercises. Students can survey fixed plots established in the Black Rock Forest with tools such as Biltmore sticks and diameter tapes to calculate wood volume, using species-specific equations. They can calculate timber values using current wood price tables. Increment cores can be used to quantify age, enabling growth rate calculations, and size-structure analysis can indicate future stand composition. Students can also calculate the amount of wood used in the Forest's green buildings and compared it to Forest volume and productivity to estimate the amount of forest represented in a typical building.

Using the GPS. In this introductory class, students learn how to operate a GPS (Global Positioning System) unit. It is recommended that students who take this class also participate in the Orienteering course.

Green Building Tour. The Black Rock Forest Center for Science and Education and the Forest Lodge are called green buildings because they were built to have a more positive impact on the environment than traditional buildings. For example, the buildings are heated and cooled using only heat pumps connected to a well system, and our bathroom toilets are waterless, composting toilets that turn human waste into soil. The concepts behind a green building are intriguing to discuss and impressive to see in reality. For example, how best can a building take advantage of the sun's energy – heat and light? Tours allow students to see and learn about these features and the many other special considerations that went into the design and construction of these two special buildings.

Humanities: Visual Arts

Photography. The forest, mountaintops, and ponds of Black Rock Forest are excellent places to pursue photography, using black-and-white and color film or digital cameras.

Sketching and Painting. Whatever the season, the Forest offers myriad sites for drawing and painting for artists of all ages. The dramatic landscape of the nearby Hudson River, inspiration for development of the Hudson River School, can readily be incorporated into trips.

Humanities: Social Studies

Ethnobotany. A general knowledge of dendrology is helpful. Hikes along any of the many trails can be used to identify plants and their historical and modern uses.

Historical Hikes. Two self-guided hikes start at the Stone House (built 1832) and go to either Eagle Cliff or Split Rock. Along the way, written descriptions explain historical highlights and Forest usage. Destinations such as the great White Oak Tree (250+ years old) and Continental Road are remnants from Revolutionary War times.

Humanities: Language Arts

Creative Writing. Many of the landmarks of Black Rock Forest have inspired poems, legends, and historical short stories. Beautiful vistas, rock formations, waterfalls, and old homesteads supply the settings. All that is needed is imagination.