PARIS MOUNTAIN

STATE PARK

241 State Park Road
Greenville, SC 29609
(864) 244-5565

We invite you and your students to visit Paris Mountain State Park and participate in an educational program.

Formerly a watershed for the city of Greenville, the 1,540-acre Paris Mountain features four stream-fed lakes, Mountain Creek, large stands of old growth hardwood forests that canopy over hiking and biking trails, a family campground, picnic areas and Camp Buckhorn, a group-camp complex.

The hardwoods are even more spectacular in the fall, when they produce the golds, reds and oranges of autumn.

Developed from 1935-1940 by the Civilian Conservation Corps, the park continues to display CCC craftsmanship in several buildings and structures.

Directions

From I-385: Take exit onto N. Pleasantburg Road (S.C. Hwy 291) for approximately 4 miles. Take a right on Piney Mountain Road. Go to the 1st light and turn right. Park is 2 miles ahead on the left.

From Asheville: Take U.S. 25 towards Greenville. Turn left onto State Park Road in Travelers Rest. Drive 8 miles (road will change names to East Mountain Creek). Take a right onto State Park Road, entrance .8 miles on left.

Reservations and Program Information

For reservations, contact:
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Park Interpreter
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Photos by Brian Gomsak

Paris Mountain State Park: *Pre-Site 1*

Content Area:
Science

Grade Level:
5

Time to Complete:
45 minutes

Title of Program:
Using pH

South Carolina State Standards Addressed
Standard 5.1: Scientific Inquiry

5-1.1 - Identify questions suitable for generating a hypothesis.
5-1.2 - Identify independent (manipulated), dependent (responding), and controlled variables in an experiment.
5-1.3 - Plan and conduct controlled scientific investigations, manipulating one variable at a time.
5-1.5 - Construct a line graph from recorded data with correct placement of independent (manipulated) and dependent (responding) variable.
5-1.6 - Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Program Description
Students will conduct activities to learn how to determine pH of water, and conduct an experiment to determine the pH level of different solutions.

Focus Questions For Students
1. What is a pH scale?
2. What are the independent, dependent and controlled variables in an experiment comparing pH levels of liquids?
3. Why is it important to know if a substance is acidic (acid) or basic (alkaline)?
4. What are some factors that could affect the pH level of a lake or stream, or of soil?

Culminating Assessment
Students will be able to draw and label the pH scale, and arrange sampled liquids based on resulting pH readings.

Materials/Equipment
Provided:
- pH paper strips (30 per class)
- 50 ml graduated beakers
- 50 ml cylinders

Recommended liquids to get:
- tap water
- distilled water
- milk
- vinegar
- Coke or other soft drink
- orange juice or other juices
- baking soda/distilled water mixture

Teacher Preparation
1. Read background information and be prepared to introduce pH.
2. Collect and label different liquids for students to use to determine pH.

Background Information
The pH is a measure of how much acid is in a liquid. 'H' refers to hydrogen ions. Hydrogen is a common element that along with oxygen forms water (2 hydrogens + 1

oxygen = $H^{2}O$).Water molecules can split, and at any instant in liquid water some water molecules break apart into positively charged hydrogen ions (H+) and negatively charged hydroxide ions (OH-). When they dissolve in water, acidic substances such as lemon juice release more H+ than OH-. Substances categorized as basic release more OH- than H+ when they dissolve in water. Thus, the more hydrogen ions that are formed in a solution, the more acidic it becomes. Scientists use a number line called the pH scale to rank the acidity of a fluid or substance. Pure water (not rain water or tap water) always contains the same number of H+ and OH- ions. This condition may occur in other fluids, and signifies neutrality. We assign neutrality a value of 7 at the midpoint of the pH scale, which ranges from 0 (most acidic, highest H+ concentration), to 14 (most basic or alkaline, lowest H+ concentration). Starting at neutrality, each change by one unit of the pH scale signifies a ten-fold increase or decrease in the H+ concentration.. The pH indicator strips change colors depending on the acidity or alkalinity of the substance being tested.

0	7	14
Acid	Neutral	Basic

The pH level is an important abiotic (nonliving) factor in determining what can live in a place. Animals have pH ranges within which they can live. Some can live in fairly acidic water or soil with a pH of 4. Others, like salamanders need a pH level closer to 6, or almost neutral. Knowing the pH of water is important in determining the quality of the water. Factors that can affect the pH of lakes, streams and forest soils include the amount of rainfall, the amount and types of leaves that fall (leaves contain tannic acid), and the type of soil near the lake or stream. Some minerals in soil can stabilize pH, acting as a buffer to counter shifts in acidity. Pollution can change pH. Knowing the pH is also important because very acidic solutions, like battery acid, and very basic solutions, like lye, are harmful to humans.

Procedures

1) Explain that pH is a measure of the acidity level in a liquid, and explain how to use the pH scale to determine if a sample is an acid, base, or neutral.
2) Demonstrate to students the correct and safe way to use equipment, avoiding spills, cross-contamination of samples, and not drinking anything in the lab.
3) Divide students into groups of 4 or 5. There are enough pH strips for 6 groups, with each group using 5 strips, and 5 beakers (use a new pH strip for each sample).
4) After telling students that distilled water has a neutral pH (neither basic or acidic) of 7, have students predict the pH level of each liquid that they will be using. Identify questions that could be used to generate a hypothesis. For example, "Since fruit juices sometimes cause lips to sting, could that be because they are more acidic? Come up with a possible hypothesis. For example, "If fruit juices are more acidic than water, then they will have an acidic pH number (low)."
5) Students collect 30 ml samples of five liquids to use during activity, and label samples on the worksheet, 1 – 5.
6) Students dip one strip of pH indicator paper into a liquid for at least 1 minute, and compare all the segments to the pH chart. Try to match all segments to the chart.
7) Students record the pH reading, and repeat for each liquid.
8) Students construct a line graph, with samples 1 – 5, and pH levels 1 – 14.
9) Discussion: Discuss why the independent (manipulated) variable in the experiment was the type of liquid, the dependent (responding) variable was the pH level, and the controlled vari-

able was the amount of water (50 ml). Students can label these on their line graph. Discuss the important role of pH level as an abiotic (non-living) factor in determining what plants and animals can live in a place, since different organisms have different tolerances for acidity. Discuss factors that determine or change pH levels in water or soil (for example, tannic acid in leaves, baseness of minerals, pollution), and the importance of knowing pH levels when assessing water or soil quality. Discuss the results of the pH experiment. For example, were solutions containing fruit juice acidic?

10) Wash and dry the beakers.

Paris Mountain State Park: *Pre-Site 2*

Content Area:
Science

Grade Level:
5

Time to Complete:
45 minutes

Title of Program:
Using a Thermometer

South Carolina State Standards Addressed

Standard 5.1: Scientific Inquiry

5-1.1 - Identify questions suitable for generating a hypothesis.
5-1.2 - Identify independent (manipulated), dependent (responding), and controlled variables in an experiment.
5-1.3 - Plan and conduct controlled scientific investigations, manipulating one variable at a time.
5-1.5 - Construct a line graph from recorded data with correct placement of independent (manipulated) and dependent (responding) variable.
5-1.6 - Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Program Description

Students will conduct activities to learn how to properly use a thermometer to determine the temperature of water, and conduct an experiment to determine how light affects water temperature

Focus Questions For Students

What is temperature?
What kind of instrument is usually used to measure temperature?
What are some factors that affect temperature?
Why would temperature be an important consideration when studying water quality?

Culminating Assessment

Students will be able to graph their temperature readings, time versus temperature. Students will be able to say that temperature is a measurement of the amount of energy in an object.

Materials/Equipment

- Alcohol-filled thermometers (1/group)
- 50 ml cylinders (1 per group)
- 250 ml beakers (3 per group)
- Timers

Teacher Preparation

Read background information and be prepared to introduce temperature as a measurement of energy.

Background Information

Temperature is a physical property of an object that measures the amount of energy in an object. Temperature is read in degrees (Fahrenheit or Celsius). Temperature is an important abiotic (nonliving) factor in the diversity of life in a place. For example, there are many more plants and animals in this part of the world than in the cold Arctic. Organisms have ranges of temperature within which they can survive. The location of a place in terms of distance from the equator, how high up, or other climatic factors can determine temperature. Changes in water or air temperature beyond an animal's range will cause it to die.

Heating of water can change the oxygen level of lakes and streams, and affect the organisms that live there. Pollution might raise temperature as it silts up the water, or reacts chemically. Removal of trees and other plants that create shade or insulation can affect temperature.

The correct and safe way to use a thermometer:

1) Hold the end of the thermometer opposite the bulb.
2) Looking at the thermometer, notice marked numbers going up in specific increments, marked with a bold line.
3) The distance between each number is consistently marked with the same number of
4) small lines. Each line represents a specific degree.
5) An indicator line (usually red) will indicate the temperature.
6) Always put thermometer bulb end down into the substance being tested.

Note: Alcohol-filled thermometers are safer than mercury-filled thermometers, and do not need to be shaken to the lowest temperature before use.

Note: The thermometers are intended to be kept in their blue plastic case at all times. If the thermometer has turned within the case, making reading it difficult, loosen the top and turn the thermometer back in place.

Procedures

1) Discuss temperature as a measurement of the amount of energy in an object.
2) Demonstrate the correct and safe use of a thermometer.
3) Identify questions that could be used to generate a hypothesis. For example, "Will the temperature of water rise if placed in sunlight, even though the room is air-conditioned? Come up with a hypothesis. For example: If the closeness to sunlight within an air-conditioned room affects temperature, then the temperature of water will rise when near a sunny window, and fall when in a dark area of the room.
4) Divide students into groups of four or five. There are enough thermometers for six groups with each group using one thermometer, one timer, and three 250 ml beakers. The 50 ml cylinders can be used in an additional activity (see Differentiation of Instruction).
5) Collect three 100 ml samples of water from the coldwater tap.
6) Holding the end of the thermometer (opposite the bulb), place the thermometer in each sample for two minutes. Let the bulb rest on the bottom.
7) Raise the thermometer and quickly read the temperature. Place the thermometer back in water for one minute, then read again. If the temperature does not change, record the temperature. If the temperatures are different, repeat steps 6 and 7.
8) Place one coldwater sample in a dark area of the room. After ten minutes, read the temperature as described in step 7, and record.
9) Place one coldwater sample in direct sunlight. After ten minutes, read the temperature as described in step 7, and record.
10) Leave one coldwater sample in an area with normal room lighting to act as a control. After ten minutes, read the temperature as described in step 7, and record.
11) Compare the initial temperature of the water samples to that of the samples after the ten minute period.
12) Discuss why the independent (manipulated) variable was the placement of the beaker of water in each of 3 locations, the dependent (responding) variable was the temperature, and the controlled variable was the amount of water (100 ml).
13) Students draw a line graph with correct placement of the independent (manipu-

lated) variable, and dependent (responding) variable.

14) With the students, come up with a statement of assumption that can be supported or refuted through experimentation. For example: "The temperature of water will increase faster if food coloring is added to make the water darker, because darker colors absorb heat better."

15) Discuss the role of temperature in determining what plants and animals can live in a place, since different organisms have different tolerances for temperature ranges.

Differentiation of Instruction

1) Change the color of the water sample to determine if color affects temperature.
2) Change the volume of the water sample (using the 50 ml cylinders) to determine the affect of water volume on temperature.

Paris Mountain State Park: *On-Site*

Content Area:
Science

Grade Level:
5

Time to Complete:
90 minutes

Title of Program:
Forest Ecology

South Carolina State Standards Addressed

Standard 5.2 The student will demonstrate an understanding of relationships among biotic and abiotic factors within terrestrial and aquatic ecosystems (Life Science).

Summarize the composition of an ecosystem, considering both biotic factors including populations to the level of microorganisms and communities) and abiotic factors.

Compare the characteristics of different ecosystems (including estuaries/salt marshes, oceans, lakes and ponds, forests, and grasslands).

Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores and omnivores), decomposers (microorganisms, termites, worms and fungi), predators and prey, and parasites and hosts.

Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

Program Description

During a walk around Lake Placid, students will conduct field investigations to observe and explore the natural forest ecosystem of Paris Mountain State Park. The focus will be on understanding relationships between biotic and abiotic factors. They will identify populations, roles of organisms, limiting factors, and take measurements of abiotic factors, while investigating the role of forests in protecting the Paris Mountain watershed. The final investigation will be a detailed survey of one square meter in the forest.

Focus Questions For Students

1. What are two abiotic and two biotic factors that influence the type of life found in the forest at Paris Mountain State Park?
2. What would be an example of an abiotic factor affecting a biotic factor on Paris Mountain?
3. Give an example of a producer and a consumer on Paris Mountain. How would abiotic factors influence this producer and consumer?
4. In what three ways does the forest on Paris Mountain protect populations in the lakes and creeks?

Culminating Assessment

Students will be able to name two abiotic and biotic factors that influence the type of life found in the forest at Paris Mountain State Park.

Students will be able to describe some of the relationships investigated on the hike: the trees (biotic) get energy from the sun (abiotic). The snakes and turtles get heat from the sun. If there is not enough water (abiotic) or unhealthy water, animals and plants (biotic) will die. When water freezes into ice (abiotic) on trees (biotic) they may break under the weight of the ice. Pine trees (biotic) are best suited to grow in the sun, in slightly acidic soil. They are one of the first trees to appear in forest succession. Students will be able to describe the role of the forest in protecting aquatic populations: 1) preventing muddy run-off; 2) filtering pollutants before sending healthy water into the lakes and creeks; 3) soaking up water like a sponge, then slowly releasing it, which prevents flooding, and provides water in times of drought.

Material/Equipment/Resources

- Clipboards, sheets and pencils for My Square Meter investigation
- Square meters
- Square meter kits (one per every 3 students): thermometer, soil thermometer, pH strip, vial of distilled water, magnifier box, hand lens
- Tape measures (one per every 3 students) to measure circumference

Teacher Preparation

1. Read background information, and be prepared to participate in activities and discussions.
2. Do pre-visit activities.

Procedures

Students are introduced to the park, and to the student's role as ecologists, investigating the relationships between living and nonliving parts of the forest. Clipboards are handed out. Students will be stopping at stations, using clues around them, plus a station clue from a bag, preparing for an up-close investigation of one-square-meter.

Station 1: Abiotic and biotic factors that make the Paris Mountain forest. The abiotic factors of temperature, amount of sunlight, amount of rainfall, rocks and acidity of the soil are discussed, as well as the plants and animals as biotic factors.

Station 2: Measuring acidity, air temperature and soil temperature. Students are introduced to the kit they will use in their one-square meter investigation, with a demonstration of how to measure ph, air temperature and soil temperature. The effect of acidity and temperature on the plants and animals that live here is discussed.

Station 3: Forest succession. At the Lake Placid dam, where plants are regularly pruned back by the park rangers, students discuss the role of abiotic sunlight in the succession of sun-loving plants to increasingly shade-loving plants in normal forest succession.

Station 4: Populations of species that live in Paris Mountain State Park. Forest ecologists study populations (a species that lives within a certain area), including the bats and owls that use bat and owl boxes.

Station 5: The amazing power of forests to 1) soak up water like a sponge, slowly releasing it, 2) filter out pollutants, and 3) hold onto soil, is demonstrated by students with the use of buckets, water from the lake, and a forested bank along the water's edge.

Station 6: Abiotic ice, biotic trees, and the role of decomposers. Students gather around sections of a tree that came down in the 2005 ice storm, and examine the role of decomposers in the forest.

Station 7: Producers and consumers. Students look at the creation and transference of energy in the forest, from the abiotic sun, to biotic plants and then animals.

Station 8: One-square meter investigation. Students split into groups of 3 or 4, and use their field sheets plus a field kit to investigate one-square-meter of the forest.

Background

Paris Mountain is located in the northeastern part of Greenville County, within the piedmont region of South Carolina. It is the southernmost extension of the Blue Ridge mountains. The area is a watershed: a region in a green mountain valley, where water drains into a common area, often a river or lake. Lake Placid is one of four lakes in the park created in the 1890s as a source of drinking water for the people of Greenville. The land has been protected since then, originally to protect drinking water. The protection of forests around an aquatic area prevents muddy run-off, pollution, and flooding, with rainwater being slowly filtered through the forest soil, into the lakes and streams.

The students will be 'forest ecologists,' studying forest ecology: the relationship between living forest organisms and their environment. The environment is determined by biotic (living) and abiotic (nonliving) factors. Biotic factors include populations of plants, animals, bacteria, and fungi that are, or were once, alive. Sticks on the ground, a millipede in the soil, and raccoons in the trees are all biotic factors. Some living organisms serve as decomposers, slowly breaking down trees that topple to the forest floor, and everything else that dies. This decomposed material helps create soil.

The living organisms of the forest make up the food web, with plants producing energy, and animals consuming it. Paris Mountain predators include snakes, foxes, and centipedes, which eat prey animals, such as mice and beetle larva. Every animal has niches in the forest: its roles (jobs) in the forest. One niche of a snake is to consume mice, thereby affecting their population numbers.

Abiotic factors include temperature, acidity, moisture, quantity of light, and the rocks of the area. All the living organisms of the forest have a range of temperature, pH, moisture, etc. within which they can live. Students will measure ground temperature, soil temperature, and pH during their field investigation.

The pH is a measure of how acidic or basic a substance is, with a range of 1 – 14, and is related to hydrogen ions (for more detail, see pre-visit activity background). A pH of 7 is neutral, not acidic nor basic. The pH number is determined by the rocks that help make the soil, acid in leaves and other biotic factors, and from man-made causes such as acid rain or other pollution. Some animals can live in soil that is fairly acidic, and some can't.

Forests are really layers of life: (1) The forest floor layer is the wastebasket of the upper layers, with all the leaves, dead animals, and other items that decompose there. It includes the animals that make their home in the soil. (2) The herb layer is made up of small, soft-stemmed plants such as ferns, grasses, and wildflowers. It receives limited sunlight. Rabbits and many other animals live there. (3) The shrub layer typically has woody, multi-stemmed plants no taller than 15 feet, such as rhododendron and mountain laurel. (4) The understory layer is made up of small, shade-tolerant trees, such as dogwoods and sourwoods. (5) The canopy layer is the top layer, represented at the park by tulip poplars, pines, oaks and hickories. These get full sunlight, and shade the lower layers.

The dominant tree populations of the park are oaks and hickories. This tells us that the forest has been protected for at least 50 years. It takes time to create a forest. First protected in the 1890s to protect drinking water, the forest became Paris Mountain State Park in 1937 - a place enjoyed by many, and home to many layers of life.

Vocabulary

Abiotic factors: the nonliving part(s) of an ecosystem (for example, water, rocks).

Adaptation: characteristic or behavior that helps an organism survive in its environment.

Biotic factors: the living part(s) of an ecosystem (animals, plants – dead leaves too).

Consumer: an organism that consumes energy made by plants (all animals consume).

Decomposer: organism that breaks down living or dead plants and animals, and recycles their nutrients (for example, fungi and bacteria are decomposers).

Diversity: the variety of species present in an ecosystem.

Ecology: the study of relationships between living organisms and their environment.

Ecosystem: all the living and nonliving parts of an environment.

Forest: a community of plants, animals, and other living and nonliving parts where trees are the most visible members.

Forest layers:

- Forest floor – bottom layer, made of soil, decomposing leaves and other organisms.
- Herb layer – layer near the ground, made of soft-stemmed small plants.
- Shrub layer – middle layer made of low woody plants with branching trunks.
- Understory layer – fourth layer up made of smaller, shade tolerant trees.
- Canopy layer – highest layer made by the tallest trees that shade the lower layers.

Habitat: the place where an organism lives.

Niche: the role of an organism in the environment.

pH: amount of acid in a solution. The pH scale is from most acidic(1) to most basic (14).

Population: all the organisms of one species in a community.

Producer: an organism that produces (makes) energy from the sun (plants are producers).

Predator: an animal that kills and eats other animals.

Prey: an animal that is killed and eaten by other animals.

Temperature: measurement of the amount of energy in an object.

Watershed: the land area that drains water into a stream, lake, or other body of water.

Paris Mountain State Park: *Post-Site*

Content Area:
Science

Grade Level:
5

Time to Complete:

Title of Program:
Post-Visit Activities

Post-Visit Activities

Take recorded data back to the classroom. Average and graph results.

Write about a year in the life of a particular organism, and discuss the changes that would take place in that time span from season to season.

Create a forest mural, showing all layers of a forest. Research the species of plants and animals found at Paris Mountain State Park. Add them to the mural.

Make a journal entry about your activities at the park.

Look at the contents of the square meter your group observed and explored. Construct a food chain and take it as far as you can go, even if all components were not seen.

Make a 3-part booklet to summarize your experience at Paris Mountain State Park:

Front page: title, name, date, and illustrations.

Page 1: "What did I do?" Explain the day's activities in detail.

Page 2: "What did I learn?" Explain interesting facts and data.

Page 3: "How could this apply to real life?" Explain how this experience could be helpful in real life, outside the classroom. Give examples.