On Top of Old Smoky

Ranger Led Program

Theme: Topography, Weather and Ecology
Grade Level: Fifth
Best Time to Plan Trip: Fall or Spring

Unit Rationale

Great Smoky Mountains National Park is world renowned for biological diversity. The influence of the last ice age on the Smokie's climate, coupled with variations in elevation, rainfall, temperature, and geology in these ancient mountains gave rise to five forest biomes and provide ideal habitat for over 1,600 species of flowering plants, at least 4,000 non-flowering varieties, 66 species of mammals, 246 kinds of birds, 43 amphibians, 38 reptiles species, 1,500 varieties of beetles and 500 types of spiders just to name a few.

State Curriculum Standards: North Carolina (Fifth Grade)

Science

Competency Goal 1: The learner will conduct investigations to build an understanding of the interdependence of plants and animals.

- 1.01 Describe and compare several common ecosystems
- 1.02 Identify and analyze the functions of organisms within the population of the ecosystem
- 1.03 Explain why an ecosystem can support a variety of organisms.
- 1.04 Discuss and determine the role of light, temperature, and soil composition
- 1.05 Determine the interaction of organisms within an ecosystem.
- 1.06 Explain and evaluate some ways that humans affect ecosystems.

Competency Goal 2: The learner will make observations and conduct investigations to build an understanding of landforms.

- 2.01 Identify and analyze forces that cause change in landforms over time
- 2.02 Investigate and discuss the role of the water cycle
- 2.03 Discuss and consider the wearing away and movement of rock and soil
- 2.05 Discuss how the flow of water and the slope of the land affect erosion.
- 2.06 Identify and use models and maps as ways of representing landforms.
- 2.07 Discuss and analyze how humans influence erosion and deposition in local communities

Competency Goal 3: The learner will conduct investigations and use appropriate technology to build an understanding of weather and climate.

- 3.01 Investigate the water cycle
- 3.02 Discuss and determine how temperature, wind speed, precipitation, cloud cover, and air pressure are affected by predictable patterns of weather
- 3.03 Describe and analyze the formation of various types of clouds
- 3.04 Explain how global atmospheric movement patterns affect local weather.
- 3.06 Discuss and determine the influence of geography on weather and climate

Table of Contents

Planning a Successful Trip On Top of Old Smoky

Schedule for a day of activities in Great Smoky Mountains National Park

Morning:
• Meet park ranger at Oconaluftee Visitor Center
• Introduction at Vistor Center
• Use restrooms at Visitor Center
• Travel to Clingmans Dome
• Break into two groups
• Lunch
• Switch groups
• Large group activity
• Conclusion on bus from Clingmans Dome to visitor center.
****Long and Short Program available (see On-site Program on page 5-6 for details)

Planning a Successful Trip

• Check the weather before you go.

• School buses can park at the program site.

• The maximum number of students for this trip is 50. One adult chaperone is required for every eight students

• Students may leave their lunches on the bus. Teachers and chaperones should bring picnic blankets for the students to sit on. All trash must be carried back to school. NEVER leave food unattended.

• Be sure that chaperones are aware of the hiking portion of this trip.

• Restrooms only available at Oconaluftee Visitor center and a limited number at Clingmans Dome. There are seasonal water fountains located at Oconaluftee Visitor center but there are no water fountains available at Clingmans Dome. Groups should bring their own drinks.

Safety Considerations and Other Important Information

• Great Smoky Mountains National Park is a federally protected public use area. Please help the rangers keep all of the plants and animals protected in the park by not picking the plants or taking anything from the park.

• Please remind your students to wear appropriate footwear and clothing for this extended outdoor experience. Flip flops, slip-on shoes, or sandals are not appropriate for the program.

• Temperatures in some parts of the park can be 10-15 degrees colder than at your school. Long pants and layers are suggested for the program. Pants are the best precaution against cool temperatures, bee stings, ticks, and poison ivy.

• Within the park, cell phones are not always reliable. Rangers will follow the on-site agenda. If an unexpected problem occurs, rangers do carry park radios to make contact with the park dispatch office. For non-emergencies, call the Park Ranger dispatch at 865-436-1230 or contact a park employee.

Animals and Plants of Concern in the park

• All animals in the park are wild and their behaviors are unpredictable. Treat all animals with caution.

• Venomous snakes - Two species of venomous snakes live in the Smokies, the copperhead and timber rattlesnake. Students should be cautious where they place their hands and feet.

• Insects - Yellow jacket wasps are the insects of greatest concern. They build nests in the ground along trails and streams and are aggressive when disturbed. Stings cause local swelling and can lead to severe allergic reactions in sensitive individuals. Such persons should carry epinephrine kits.

• Poison Ivy - Poison ivy is a three-leaved plant which can grow on the ground as well as on "hairy" vines up trees. To avoid chances of an allergic reaction wear long pants, stay on trails, and avoid direct contact with vegetation. If contact occurs or is a concern, wash affected parts in cold soapy water immediately.

• It is extremely helpful to rangers leading the program for students to wear clearly labeled name tags with first names only.

• Pets are not allowed on most park trails. Please do not bring them on the field trip.

• For more information about the park (Things to Know Before You Come) please visit the park's website: http://www.nps.gov/grsm/planyourvisit/things2know.htm

Background Information

Park Description:

The National Park Service is charged with the management and preservation of the nation's most precious natural and cultural resources. These resources are woven into our natural heritage, and they provide opportunities for recreation, appreciation of beauty, historical reflection, cultural enrichment, and education.

Great Smoky Mountains National Park is one of the largest protected land areas east of the Rocky Mountains. With over 500,000 acres (800 square miles) of forest, the Smokies contain an enormous variety of plants and animals. In terms of biological diversity, a walk from a mountain's foot to its peak is comparable to the 2,000 mile hike on the Appalachian Trail from Georgia to Maine.

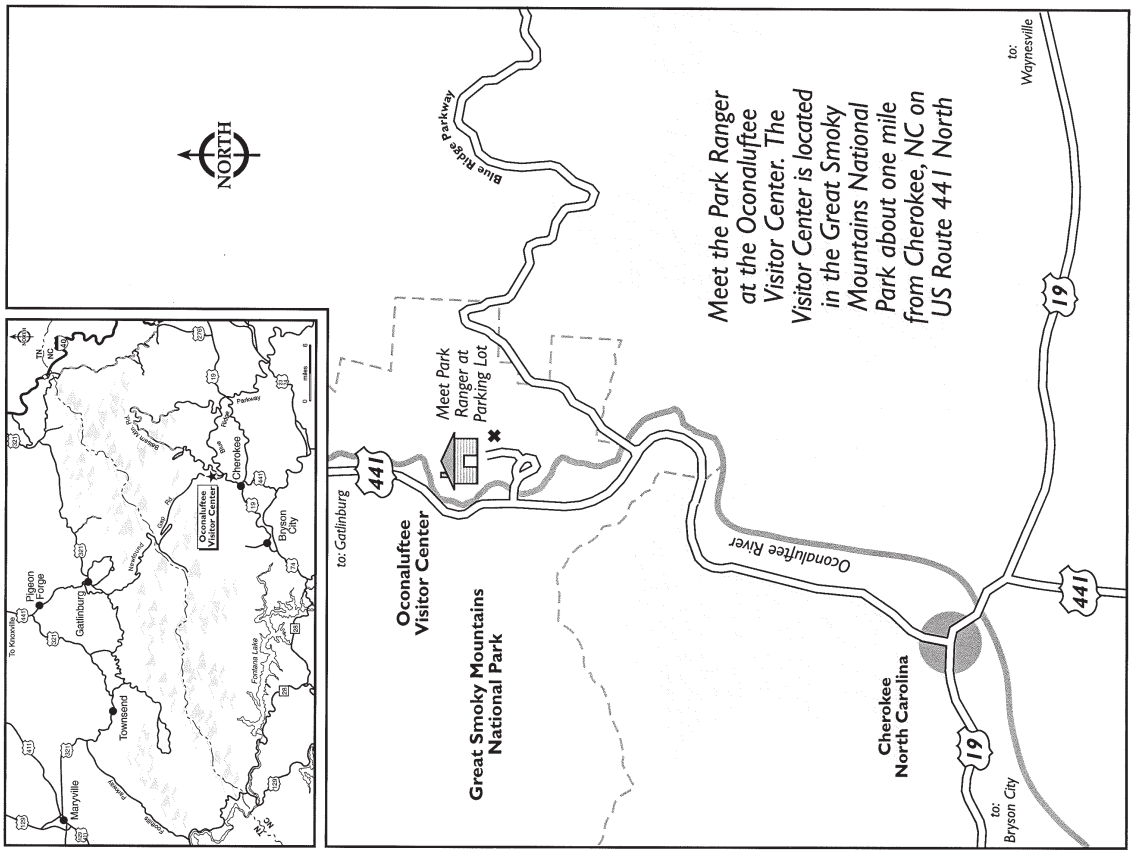
Because the National Park Service is charged with protecting resources and natural systems, the park engages in comprehensive research programs, such as air quality monitoring, to foster an understanding of park resources and to show how they are affected by local, regional, and global influences. Since the Smokies are so biologically diverse, the park is designated as an International Biosphere Reserve by the United Nations. The international system contains over 320 reserves in over 80 countries with the primary objectives of conserving genetic diversity and coordinating environmental education, research, and monitoring.

The Smokies also have a rich cultural history. Native Americans have lived in this area for thousands of years, and permanent white settlement began around 1800. The coming of commercial logging around 1900 stripped trees from two-thirds of what is now park land. Established in 1934, the park was created from more than 6,000 tracts of private and commercial land that was bought mostly with money raised and privately donated. Centrally located within a two-day's drive for half of the nation's population, Great Smoky Mountains National Park has the highest visitation of all the national parks in the country.

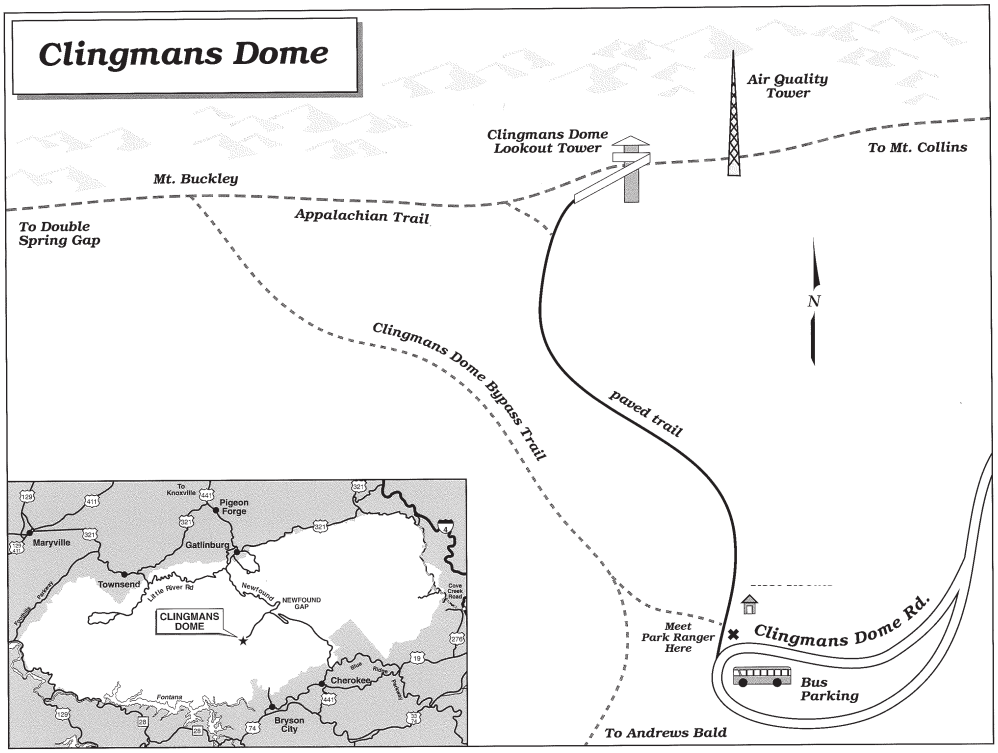
Clingmans Dome Description:

Clingmans Dome, towering 6,642 feet above sea level is the highest peak in the Smokies. The peak was once called Smoky Dome, but was renamed Clingmans Dome in honor of U.S. Senator and Confederate brigadier general, Thomas Clingman. The seven-mile spur road to Clingmans Dome follows the border between TN and NC. The road leads to a parking area some 332 feet below the summit. From there it is a steep half-mile walk on a paved trail to the peak. Along the way the path climbs through a spruce-fir forest. This type of forest, rarely found in the southern Appalachians, is a remnant of the ice age. The walk and organized activities will give students the opportunity to learn about this forest community, its inhabitants, and the dangers this fragile forest community faces. At the peak a 375 foot ramp spirals upward to a 45 foot observation tower, allowing a view above the trees. This is the third highest mountain east of the Mississippi river. Mt. Mitchell and Mt. Craig, 70 miles west in Yancey County, North Carolina, are both slightly higher.

Map To Oconaluftee Visitor Center



Map To Clingmans Dome



Pre-Site/Post-Site Test

Pre- Site Score_____
Post-Site Score_____

Name_____

Write T for True or F for False

_____ 1. Air quality, fire management, and education are not important issues in the Park.

_____ 2. The Balsam Woolly Adelgid is native to the Great Smoky Mountains ecosystems.

_____ 3. The Spruce-Fir forest community is found only in the higher elevations (above 4,500 feet) of the Great Smoky Mountains National Park.

Circle the letter of the correct answer.

4. Acid in the air from the burning of fossil fuels by power plants and industries produces:
a. sulfur dioxide and nitrogen oxides
b. oxygen and nitrogen oxides
c. lead and mercury

5. Industries, government agencies, schools and individuals can work together to
a. reduce air pollution
b. help research and solve park problems
c. stop the destruction of park resources (like carving and writing on the cabins and trees of the park or removal of wildflowers and other plants)
d. all of the above

6. Information shown on a graph is _____ and is useful in _____.
a. exploring maps/problem solving
b. making assignments/defining words
c. data collected/organizing information

7. It is illegal and potentially harmful to do which of the following in the national park?
a. feed bears and other wildlife
b. camp and hike in the backcountry
c. take a nap in the Spruce-Fir forest on top of the mountains

8. Air pollutants are carried to the local forests by
a. rivers and streams
b. animals and people
c. rains, clouds, and snow

9. The Balsam Wooly Adelgid feeds on the tree's _____ and injects a _____.
a. needles/small amount of water
b. bark/nutrient
c. sap/toxin

10. While hiking you should always
a. walk along off the trails so not to damage the wilderness
b. follow the stream especially while walking at night
c. hike with a buddy and let someone know where you are going and when you will return

Pre-Site/Post-Site Test Continuted

11. An existing threat to Great Smoky Mountains National Park is
a. not enough rainfall
b. no visitors
c. air quality

12. Air pollution causes
a. poor visibility
b. threats to health of plants and animals
c. both of the above are correct

13. An adelgid population consists of wingless females that spread from tree to tree by
a. jumping off the backs of tourists
b. moving water and rain
c. wind

14. How are Park Resource Managers slowing the destruction of the Fraser fir by the adelgid?
a. spraying a soap mixture on the tree trunk is with first hoses
b. using a mild poison at the base of the trees
c. spraying the trees with chemicals from airplanes and helicopters

15. Air pollution that effects the Smoky Mountains comes from
a. cities surrounding the area and automobile traffic
b. cities far away such as Chicago, IL
c. all of the above

16. An example of a good chain would be
a. sun-soil-plant-insect-salamander-owl-human
b. sun-tree-insect-spider-salamander-shrew-owl-soil
c. soil-plant-insect-bird-tree-flower-insect-plant-soil

Pre-Site/Post-Site Test
Teacher Answer Sheet

Write T for True or F for False

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Pre-Site Activity
Temperature and Elevation

Grade Level: Fifth

Subject Area: Science

Activity time: 30 minutes

Setting: Classroom

Skills: Collecting information, Comparing, Connecting, Discussing, Hypothesizing, Inferring, Predicting,

Objectives:
1) Calculate changes in temperature as elevation changes.
2) Understand why temperature changes with elevation.
3) Understand the health risks associated with extreme temperature changes.

Materials:
• Background information sheet
• Activity sheet

Background:
\Great Smoky Mountains National Park offers a wide range of activities for its ten million annual visitors. Pre-trip planning and weather-wise clothing will help ensure an enjoyable visit anytime of the year and reduce the risk of hypothermia (over exposure to the cold). It is helpful to keep in mind that elevations in the Park range from 800 feet to 6,643 feet in elevation and that the topography of the mountains can drastically affect local weather. Temperatures from mountain top to mountain base can vary by 20 degrees Fahrenheit or more. Clear skies in the low elevations do not guarantee pleasant weather higher up. Describe the elevation of Clingmans Dome and introduce the concept of altitude.

Procedure:
Describe the range of elevation in Great Smoky Mountains National Park. Elevations in the Park range from 800 feet to 6,643 feet. Coupled with the topography of the mountains can drastically affect local weather.
Have students review the temperature chart listed on the following page. Temperatures are in degrees Fahrenheit. Have students answer the questions listed below the chart.

Extension: Research and compare their results with elevations of mountain ranges that are taller than Clingmans Dome (i.e. the Rocky Mountains In Colorado, the Himalayas, Mt. Everest, etc.)

Temperature and Elevation

Name _____

Gatlinburg, TN elevation 1,462 feet			Clingmans Dome, TN/NC elevation 6,643 feet	
Month	Average High	Average Low	Average High	Average Low
January	51	28	35	19
February	54	29	35	18
March	61	34	39	24
April	71	42	49	34
May	79	50	57	43
June	86	58	63	49
July	88	59	65	53
August	87	60	64	52
September	83	55	60	47
October	73	43	53	38
November	61	33	42	28
December	52	28	37	21

Questions:

1. On average, which is the coldest month of the year at Clingmans Dome? Which is the warmest?

2. Based on the above information, write a statement or hypothesis about what you believe the weather will be like on the day of your field trip on top of Clingmans Dome?

3. Temperatures can vary 10-20 degrees from the bottom of the mountain to the top. Temperature usually drops three degrees for each 1000 feet of elevation. With this information, figure out the following: A teacher has planned a class trip to Clingmans Dome in October. The temperature at the school is expected to be 60 degrees on that day. Research the elevation at your school and determine what the temperature at the Dome will be by using the above calculation. What would be the best clothing to what for the field trip based on the predicted temperature?

Pre-Site Activity
Safety

Grade Level: Fifth

Subject Area: Science

Activity time: 15-20 minutes

Setting: Classroom

Skills: Collecting information, Connecting, Discussing, Hypothesizing, Inferring, Identifying cause and effect

Objectives:
1) List at least three items to carry with them when they hike with their families in the woods.
2) List three methods to keep from getting lost.
3) Identify the most important thing to do when lost.
4) Discuss and identify three dangers in the woods and know how to avoid them.

Materials:
•Teacher discussion sheet on safety

Procedure:
Discuss the safety sheet and potential dangers students might encounter in the Park. Identify items the students might carry with them when they visit the park with their families. Discussion methods to keep from getting lost and identify the most important thing to do if lost. Student task is to participate in discussion. Summarize safety issues discussed during the lesson.

Extension:
Create a list of terms that would be necessary to safely day hike in the mountains.

Safety Lesson-Teacher Discussion Sheet

Park Hazards: Include rocky, uneven trails; stinging insects; poison ivy and other irritating plants; snakes; changing weather conditions.

Avoid potential dangers by:
- staying together as a group
- not running or playing rough
- watching where you put your hands and feet
- knowing how to identify poison ivy
- knowing of any allergies or conditions that may cause concern on the trail

Avoid getting lost by:
- hiking with a group at all times
- staying on established marked trails at all times
- reading and understanding all trail signs
- taking along a good map and knowing how to read it
- letting others know where you are and when you will return

If you get lost:
- Stop, wait, and blow your whistle

Words to the wise:
- If you can carry it in full, you can carry it out empty. Pack out all trash
- The park is a living museum where all living and nonliving things are protected ny law.
- Boil or treat all of your drinking water. Never drink from a stream even if it looks pristine.
- Use caution when walking near streams. Wet and moss-covered rocks can be slippery.
- Pair off into a "buddy system" and keep track of your buddy.

Items for hiking:

Necessary	Optional
•day pack	•compass
•water	•extra clothes
•lunch or snack	•map
•whistle	•guide books
•rain gear	•hat
•first-aid kit, any personal medication	•pencil and paper

Pre-Site Activity
Air Quality

Grade Level: Fifth

Subject Area: Science, Social Studies

Activity time: 30-45 minutes

Setting: Classroom

Skills: Collecting information, Connecting, Discussing, Hypothesizing, Inferring, Identifying cause and effect

Objectives:
1) Identify sources and effects of air pollution
2) Plot a course and measure distance on a map

Materials:
•Background Information Sheet
•Student Activity Sheet
•Map

Procedure:
Ask the students to think about differences in technology and the environment by imagining what it was like for a Cherokee youth living in the Smokies in the 1760s. Discuss the causes and effects of air pollution in the Great Smoky Mountains National Park using te air pollution background information.
Have the students complete the mapping pollution activity and supervise the *Pollutionary* game

Extension:
Create a chart at school that displays the daily air quality index. Local newspapers often list an air quality section on the weather page. Adjust chart daily so that all students will know the air quality in your area.

Background Information
Air Quality

Acid Rain

The catch phrase "acid rain" was first coined in 1852 by Robert Angus Smith, a scientist living and working in England. Acid rain, however, only describes one of the routes whereby acids are added to our ecosystems. The term "acid precipitation" is more encompassing and includes rain, sleet, hail, snow, fog, dew, etc.

Burning of fossil fuels for electric power generation and heating, industrial processes, and transportation release sulfur dioxide and nitrogen oxides into the atmosphere in a dry form. They react with moisture to oxidize creating sulfuric and nitric acids. The acids dissolve in cloud droplets and raindrops and are deposited on the ground via precipitation.

Rainfall in the Southern Appalachians is more than five times as acidic as normal. Cloud water acidity is even more severe. Acid deposition affects plants, streams, lakes and other aquatic resources.

The Smokies Haze

The bluish haze which gave the Smokies its name was produced largely by forest vegetation. Leaves of countless trees and other plants emit great amounts in of moisture and natural chemicals into the air which react to form a visible suspension.

Today, during periods of summer air stagnation, this natural haze is almost insignificant compared to man-made pollutants that make up over 70% of the whitish haze that obscures your view of the distant mountains. Sulfates which come from burning coals and oil account for most of the haze in the southern Appalachians. Scientist constantly monitor air pollution and study its effects on the Park's resources. Thick haze from pollution frequently obscures the view from Clingmans Dome, and the dead tops and thinning crowns of spruce trees are signs of extreme stress.

Ozone

Another air quality problem, ozone pollution, is also responsible for damaging plants in the Park. Not to be confused wit the beneficial ozone layer which shields us from the sun's harmful rays, ground level ozone pollution is produced when nitrogen oxides mix with sunlight and natural hydrocarbons.

Ozone pollution can affect breathing in people and damage plant life. Research shoes that 30 species of plants suffer leaf damage at ozone levels that occur in the park. Ozone concentrations over the ridgetops of the park are the second highest in the U.S. (after California) an have even reached the federal public health standards, potentially threatening the health of visitors to the park.

Pollutionary Game

Break into teams. One person from each team comes to the blackboard. The person is given one of the following words or phrases. That person will draw something that will help his teammates guess what the word or phrase is. Other phrases and words can be created by the students. If there is any class time left you will want to award extra points to the team that can list the most solutions to the problems of pollution (such as recycling, putting cleaning devices on smokestacks, designing electric cards, etc.)

Pollutionary Phrases: Wind currents
Acid rain
Acid rain hurts the Smokies
Cars cause pollution
Ozone can make you cough
Smokestacks
Acid rain gets in the water
Winds can carry pollution

Mapping Pollution

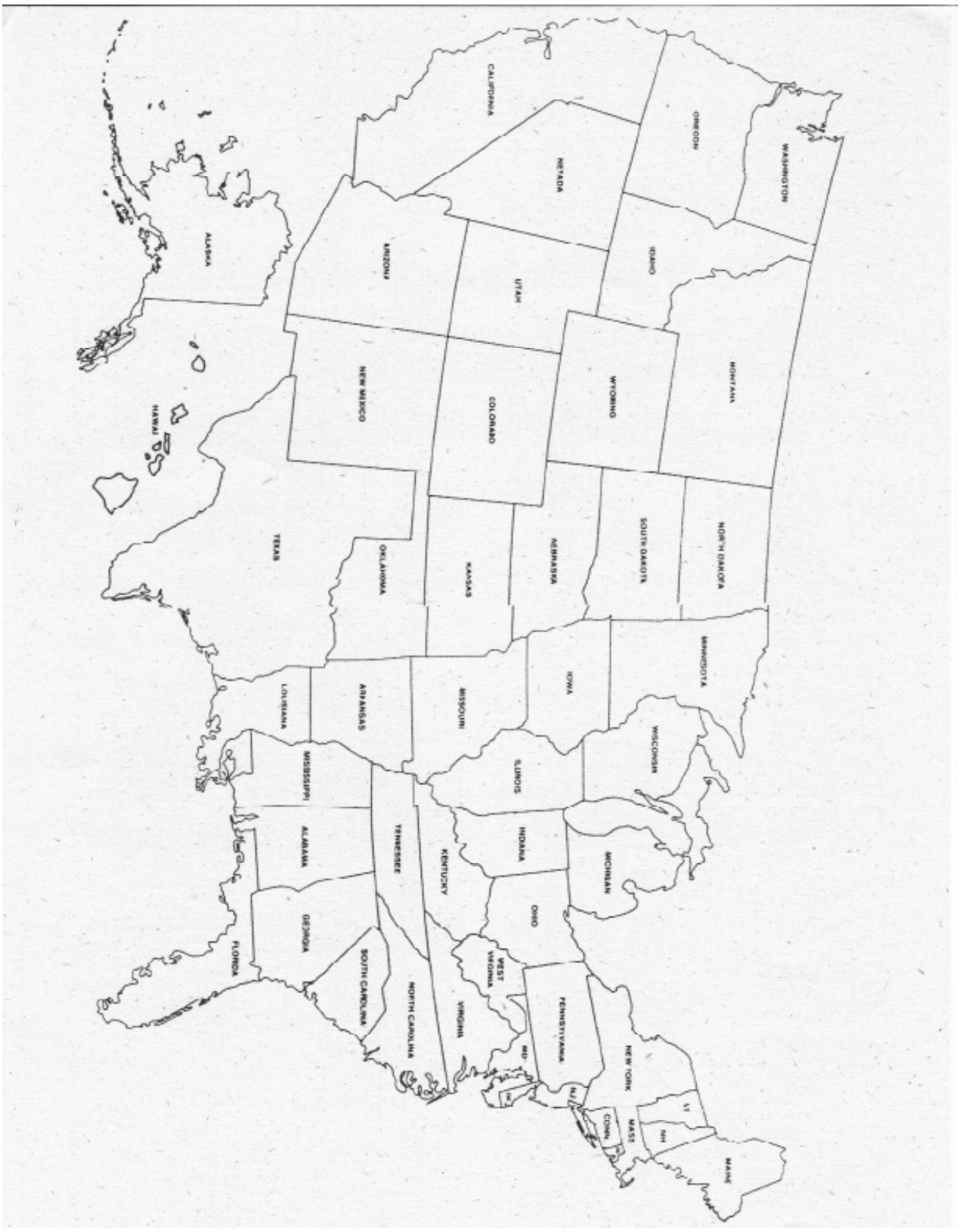
Look at the map on the following page. Copy the map for each student before class. Use the facts below draw a line tracing the path of a storm system. You should also label the cities the storm moves through. This storm will move from Chicago, IL, where it will pick up pollution from several manufacturing plants to Indianapolis, IN, where it will pick up a large dose of car exhaust. From there the storm hits Louisville, KY accumulating more pollutants. Then it moves across Nashville, TN. The storm is slowing down, but still picking up dirty air ass it goes. Finally the storm moves into Knoxville, getting a dose of pollution from nearby coal-fired power plants. Then this dirty air moves into the Great Smoky Mountains National Park, where it settles. See if you can answer the following questions.

A. Use a ruler measure the distance the storm traveled. Roughly how far did it travel? Map scale is one inch = 200 miles.

B. If the storm moved at a rate of one hundred miles a day, how long did it take it to reach the Smokies?

Summary:
You can see that the pollution from far away does affect the Park. It also affects you as a visitor to the Park, though you may not notice it. Just fifth years ago visitors could see an average of one hundred miles, now a visitor can see an average of just twelve to nineteen miles. The white haze that hands over the Smokies an blocks the beautiful mountain views is not natural - it's pollution. Most of this pollution is made up of chemicals called sulfates. Sulfates are produced by burning coal and oil.

United States Map



On-Site Activity
Park Ranger Directed Lessons

Grade Level: Fifth

Subject Area: Science

Activity time: 3 hours (including a lunch break) for short program and 5 hours (including lunch break) for long program)

Setting: Outdoors in the park

Skills: Collecting information, Communicating, Connecting, Discussing, Experimenting, Gathering information, Hypothesizing, Identifying cause and effect, Inferring, Listening, Measuring, Predicting, Public speaking, Recording data, Role playing,

Vocabulary:

* Acid precipitation- rain or other precipitation having a pH below the normal ph5.4, often caused by air pollution from the burning of fossil fuel.

* Adaptation- The ability of organisms to change in order to survive in a particular habitat.

* Air pollution- The contamination of the atmosphere by noxious gases and particulates. Most of the air pollution that affects the park comes from urban area and coal burning power plants outside park boundaries.

* Balsam woolly adelgid- Adel gis picea, is a small insect that attack the Fraser fir (Abies fraseri). This pest was accidently introduced from Europe in the early 1900's.

* Barometric pressure-the force exerted against a surface by the weight of air above that surface.

* Coniferous- Any tree or shurb that bears cones such as pine, fir, and spruce.

* Deciduous- Trees and shrubs that lose their leaves during seasonal changes.

* Ecosystem- The living and non-living components in an area.

* Haze- dust, smoke and other dry particles obscure the clarity of the sky. Much of the haze seen around the park is due to air pollution.

* Prevailing winds- The usual direction air travels in an area. In this **reg**ion the prevailing winds are West to East.

* Topography- the study of Earth's surface shape and features.

* Watershed- The drainage basin or area in which surface water drains toward a lake, stream, or river at a lower elevation.

Objectives:

1) Describe the differences between several ecosystems found in the region.
2) Identify the function of producers, consumers and decomposers.
3) Explain 3 ways humans affect ecosystems.
4) Define a watershed.
5) Discuss how the movement of water over the landscape shapes landforms.
6) Explain how the mountains influence the local weather patterns and pollution concentrations.

Materials: provided by park rangers

Background:

Listed to the right is an example of itinerary for the short program (3 hours) and long program (5 hours).

* Introduction: Landforms Wind and Water - 30 minutes(at Oconaluftee Vistor Center)
Shower curtain demonstration -15 minutes
Balloon activity and hypotheses development - 15 minutes

* Bus ride to Clingmans Dome: A park ranger will accompany the students on the bus and will discuss Great Smoky Mountain ecology, biodiversity, human history, and threats to the ecosystem.

* Arrive at Clingmans Dome (Options for Short and Long programs)

* Short and Long Program Itinerary listed below.

Short Program Itinerary:

10:45- All students walk to tower giving a few minutes separating groups.
Point out topographic features along trail.
11:15- Group A visits tower and collect weather data using weather instruments.
Group B- Food web game
11:45- Lunch
12:05- Switch groups
12:35- Return to bus
1:00- Bathroom break
1:15- Board bus
Conclusion- on bus

Long Program Itinerary:

10:45- Split groups into two groups
Group A: Hike bypass trail. Point out high elevation tree species and discus adaptations. Discuss water cycle and landforms.
Group B: Discuss invasive species on fir and hemlock trees. Conduct Food Web Game - 20 minutes
12:00- Group A: Finish hike and begin lunch
12:20- Group B: Finish hike and begin lunch
12:20- Group A: conduct weather stations and climb tower
12:50- Group B: Conduct weather stations and climb tower while Group A begins Food Web Game
1:20- Conclude activities and return to bus.
1:45- Restroom break
2:00- Board bus
Conclusion- on bus

Post-Site Activity
Observing Air Pollution

Grade Level: Fifth

Subject Area: Science, Language Arts, Social Studies, Health, Mathematics

Activity time: 30-45 minutes

Setting: Indoors

Skills: Collecting information, Connecting, Brainstorming, Analyzing, Experimenting, Presenting, Communicating

Objectives:
1) Define what air pollution is
2) List sources of air pollution around their community
3) Describe what air pollution can look like

Materials:
* 2 large lids from jars of coffee cans
* Petroleum jelly
* Scissors
* Hand lens/microscope
* Microscope slides
* Glue
* 1 sheet of black/1 sheet of white construction paper

Procedure:
Discuss terms utilized and concepts discussed during completion of the unit. Demonstrate how to cut construction paper and create collection"lids" for experiment. Supervise experiment and development of charts. Summarize what the students learned about air quality, high elevation forest communities, and threats to the high elevation forest.

Creation of collection "lids"

1. Using the jar lids as patterns, draw and cut out a black paper circle and a white paper circle.

2. Fold each circle. Then cut each circle in half along the fold line.

3. Glue one white half-circle and one black half circle in each lid.

4. Cover the paper in each lid with a thin coating of petroleum jelly.

5. Leave the lids in place for 2 days.

Analysis:
Use a hand lens to observe the particle pollution each lid collects. You could also smear a microscope slide with petroleum jelly from each slide and observe the pollution with a microscope. Char the number, and possibly type, of particles collected in each location.

Application:
1. Which lid collected the most particles?

2. Compare the lid you left inside the classroom with other lids left inside the classroom. Did all of the lids collect the same number of particles? Why or why not?

Local newspapers often list an air quality section in the weather section of the paper. Create a chart of particle pollutant counts throughout the year to determine when the air quality is best and worst.

Extension:
Find out what kinds of fuels students burn at home. Include fuels used in cars, trucks, stoves, furnaces, hot water heaters, and clothes dryers. Make a class chart showing the kinds of fuels your class uses.

Post-Site Activity
Exotics

Grade Level: Fifth

Subject Area: Science, Social Studies

Activity time: 30-45 minutes

Setting: Classroom

Skills: Collecting information, Connecting, Brainstorming, Analyzing, Experimenting, Presenting, Communicating

Objectives:
1) Describe what an exotic species is and why exotics are a threat to native species
2) Be able to list two exotic species that are causing problems in the United States
3) Be able to list two exotic species in the Great Smoky Mountains National Park

Materials:
* Activity sheets
* World Map

Procedure:
Refresh students on what an exotic is. Compare it with a native species. Summarize what the students learned at Clingmans Dome regarding exotics. Play the Exotic Invasion Game with students and lead class discussion of exotics.

Divide the class into groups. Tell them they will be playing a guessing game. You will read them a series of five clues. After you read each clue, give them a moment to think of the correct answer to write down on a piece of a paper. A group representative will bring the answer to you. Even if a group feels they have the answer after only two clues, read all five clues. When all the clues are read, every group must submit an answer. Note the order in which the groups bring you their answers. The first group with the correct answer gets five point, the second, four, etc. Students can confer with their group but at no time should they shout out their answers or discuss them with a competing group. Add up the group's points before the end of the game. You may also wish to have a world map handy so students can see where these exotics came from and how far they traveled.

Summarize what the students learned about exotics and their impact. Exotics can be fungi, germs, insects, mammals, reptiles, birds, or plants. Not all are harmful, but many can have an incredible impact on man and the environment. As people travel greater distances at faster speeds, exotics will become more of a problem. Students can help us in the Smokies by educating other, by volunteering their time (to pull up Japanese grass, or plant a native tree, for example), and by never taking anything into or out of the Park.

Extension:
Pick one exotic that has affected your area of the country and do an oral report on it.

Exotic Invasion Game

Exotic #1

Exotics are not a new problem. In fact we'll go back several hundred years, back to the Dark Ages, for our first exotic. Nowadays we worry about exotics harming native plants and animals, but we should remember that anything that affects the environment also affects us, and could do us a lot of harm. As I read these clues, keep in mind that an exotic insnt always an animal, plant or insect.

Clue 1. I came from the Middle East to Europe in the 1300s.
Clue 2. I hitched a ride with some fleas in the fur of rats that came by ship to Europe.
Clue 3. A few hundred years ago I made over 1/3 of the people in Europe get sick and die.
Clue 4. The disease I cause made their tongues turn black. That's where I got my name.
Clue 5. Just recently I popped up again, this time in India.

Exotic #2

We see that exotics are a problem all over the world. The exotics we've talked about came from very far away to their new home. Some exotics in the U.S. didnt travel so far. They just moved from one state to another. That's what happened with our next exotic.

Clue 1. I live in the Rocky Mountains, but was trasnported to Oregon and Washington.
Clue 2. I love mountains, and I'm a great climber.
Clue 3. I get very hungry and eat native plants and grasses other animals need.
Clue 4. People enjoy looking at me. Maybe it's my big horns.
Clue 5. You can find some of my relatives on any farm in North Carolina. You can even find relatives of mine in Hawaii. I'm a big problem there, too.

Exotic #3

Some exotics are bad not only for the environment, but they hurt us economoically. Our next exotic is one of the biggest environmental problems we have today. This exotic seems to be spreading all over the country.

Clue 1. I came over by getting in tanks filled with water in the bottom of ships from the Middle East. These tanks help balance the ship and were a perfect home for me.
Clue 2. I attach myself to drain pipes, sewage lines, etc. I clog and damage pipes.
Clue 3. My North Carolina cousins are unhappy to see me. I eat too much of their food. That 's bad because these native species are big business in North Carolina. The Japanese make pearls from them.
Clue 4. The first part of my name refers to my black and white shell (African animal).
Clue 5. I got the last part of my name becuase my whole body is one of these. Hint: What does Arnold Schwarznegger have a lot of?

Exotic #4

We've talked about exotics in other countris and other parts of the U.S. Now, let's talk about problems here in the Smokies. As you know from our visit to Clingmans Dome exotics are a big problem here in the Great Smoky Mountains.

Clue 1. I was brough to this country from Asia to stop erosion. I am good for the soil.
Clue 2. I can grow as much as two feet per day.
Clue 3. You've probably seen me growing all over hillsides in North Carolina
Clue 4. You can make baskets, cookies, medicine, and even gravy from me.
Clue 5. Unfortunattely, I grow too fast. I choke out native plants.

Exotic #5

Our next exotic has been in the Smokies a little less than a hundred years, but this exotic has multiplied fast. I bet lots of you have seen one of them, maybe even touched one.

Clue 1. I was brough from Europe because people thought it would be a lot of fun to catch me.
Clue 2. I'm brightly colored, that's how I got my name.
Clue 3. I'm kind of a bully, so I chase my native cousins here in the Smokies upstream where they don't breed as well.
Clue 4. I was first realeased here in the Smokies in the area that's now called Elkmont campground.
Clue 5. One of my other cousins is found in the Smokies. He doesnt belong here either and was also brought in for people to catch. He's not as attractive as I am. He's brown.

Exotic #6

Now let's talk about the most famous exotic here in the Smokies

Clue 1. I was brough from Russia so people could hunt me. I was penned up in a game preserve in North Carolina, but about 70 years ago I got loose and now there are lots of me.
Clue 2. Females of my species can have thirteen babies at a time, twice a year.
Clue 3. I was a little worried when there were red wolves in the Smokies because they like to eat me.
Clue 4. I like to stick my snout in the ground and root up plants. I have a healthy appetite too, so I take away a lot of food from native animals.
Clue 5. As you walk through the Great Smoky Mountains National Park, you may see traps set out to catch me.

Answers.

1. ***Black plague (Bubonic plague)***
2. ***Mountain goats***
3. ***Zebra mussels***
4. ***Kudzu***
5. ***Rainbow trout***
6. ***Wild hog***

Post-Site Activity
Explore Your National Parks

Grade Level: Fifth

Subject Area: Science

Activity time: 30 minutes

Setting: Indoors

Skills: Computer skills, research, collecting information, connecting, brainstorming,analyzing, presenting, communicating

Objectives:

1) List three features of Great Smoky Mountains National Park that make it special.
2) Name several other national parks in their home state.
3) Name ten national parks across the country.
4) Be able to explain who owns all national parks.
5) Earn their online web ranger certification.

Materials: internet access

Background:

The Great Smoky Mountains are world renowned for their diversity of plant and animal species. This great variety makes the park an exemplary outdoor laboratory for the study of relatively undisturbed native flora, fauna, physical environs, and processes of the Southern Appalachians. The park is the largest federally preserved and protected upland area east of the Mississippi River offering park visitors a refuge from the stresses of everyday life.

You and your students can learn more about this special place as well as participate in on-line activities to further your knowledge of the National Park Service and other federally protected lands. Please check out the following web addresses:

Especially for Kids

To learn how to become a web ranger for the National Park Service, go to:
www.nps.gov/webrangers
To learn how to become a Junior Park Ranger at Great Smoky Mountains National Park or other parks, go to:
www.nps.gov/learn/juniorranger.htm

Especially for Teachers

For a comprehensive understanding of the background and development of the National Park Service, that is perfect for teachers and others those who need the maximum amount of accurate information in the minimum amount of time, go to:
http://www.ParkTraining.org
The U.S. Department of Education is pleased to announce the newly remodeled and updated Federal Resources for Education Excellence (FREE) website.
It now provides richer, more expansive resources to teachers and students alike. There are over 1,500 resources to take advantage of at FREE ranging from primary historical documents, lesson plans, science visualizations, math simulations and online challenges, paintings, photos, mapping tools, and more. This easily accessible information is provided by federal organizations and agencies such as the Library of Congress, National Archives, National Endowment for the Humanities (NEH), National Gallery of Art, National Park Service, Smithsonian, National Science Foundation (NSF), and National Aeronautics and Space Administration (NASA). Go to:
http://www.free.ed.gov/

Parent/Chaperone Letter

Greetings Parents/Chaperones:

Park rangers are pleased to be presenting an educational program to the students in Great Smoky Mountains National Park. In order to achieve the goals for a successful program, the park rangers will need your assistance in the following ways:

(These points will help to ensure that rark rangers and teachers will be able effectively conduct the lessons and activities throughout the trip.)

- The program will be conducted outside and there will be some hiking throughout the trip. Prepare your student with appropriate footwear, long pants, layers, and raingear.

- If your child is bringing a lunch from home, we recommend that students bring water to drink and a lunch with minimal packaging. Soft drinks are usually left unfinished by students, and remaining sugary drinks cannot be poured out on the ground. (Minimally packaged lunches lead to less trash being left behind or scattered by the wind. Additionally, this reduces the accumulated trash to be disposed of).

If you are a chaperone attending the field trip:

-Please be an active part of the lessons. Keep up with the group and listen to the information being given in the case that you may be called upon to assist (handing out materials, sub-dividing groups etc.).

-Please do not hold conversations with other chaperones or use a cellular phone while the rangers are teaching the students.

-Refrain from smoking during the trip. If you must smoke, please alert a ranger or teacher and remove yourself from the group.

-Please be aware that the program will be conducted outside and that there will be some hiking throughout the trip. Prepare yourself with appropriate footwear, long pants, layers, and raingear.

-We recommend that parents and students bring a small towel in their backpacks to sit on at lunch (there are no picnic tables at the program site).

Thank you for your needed assistance. We look forward to meeting you on the program!

Sincerely,

The Education Staff at Great Smoky Mountains National Park