

Contact Without Impact

Great Smoky Mountains National Park Quarter

Grades Nine through Twelve



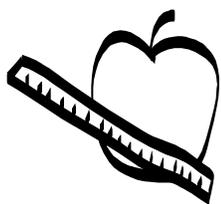
OBJECTIVES

Students will evaluate how different modes of travel impact the environment. Students will propose persuasive solutions to reduce carbon footprints.



MATERIALS

- 1 overhead projector or equivalent technology (optional)
- 1 overhead transparency (or photocopy) of the “Great Smoky Mountains National Park Quarter” page
- 1 class map of the United States
- Copies of the following:
 - “Great Smoky Mountains National Park Quarter” page
 - “Footprints” worksheet
 - “Contact Patches” worksheet
 - “Trail and Road Map”
 - “Contact Planner” worksheet
 - “Without Impact Rubric”
- Graph paper
- Calculators
- Rulers
- Scissors
- Clear tape
- Rubber bands
- Colored pencils
- Twine
- Class set of computers with Internet access or use of computer lab for two sessions
- Web sites that give information about maps, locations, trails and roads within the Great Smoky Mountains National Park, such as:
 - Maps of Great Smoky Mountains National Park at www.nps.gov/grsm/planyourvisit/maps.htm
 - Maps of Great Smoky Mountains at www.loc.gov/collections/national-parks-maps/special-presentation/maps-of-great-smoky-mountains-national-park
 - Front Country Camping at www.nps.gov/grsm/planyourvisit/frontcountry-



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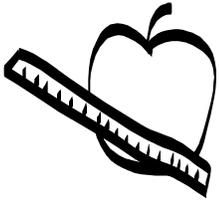
[camping.htm#CP_JUMP_104655](#)

- Web sites that give information about the history of the Great Smoky Mountains, such as:
 - Historic Buildings at www.nps.gov/grsm/planyourvisit/historicbuildings.htm
 - Stories at www.nps.gov/grsm/historyculture/stories.htm
 - Maps of Great Smoky Mountains at memory.loc.gov/ammem/gmdhtml/nphhtml/gsmhome.html
- Web sites that give information about calculating or minimizing our carbon footprint, such as:
 - A Student’s Guide to Global Climate Change at www.epa.gov/climatechange/students/index.html
 - My Trip Calculator at www.fueleconomy.gov/trip
 - Climate Friendly Parks at www.nps.gov/grsm/naturescience/climate-friendly-park.htm

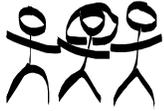


PREPARATIONS

- Make an overhead transparency or equivalent of the “Great Smoky Mountains National Park Quarter” page
- Make copies of the following:
 - “Great Smoky Mountains National Park Quarter” page (one per student)
 - “Footprints” worksheet (one per student)
 - “Contact Patches” worksheet (one per student)
 - “Trail and Road Map” (one per group)
 - “Contact Planner” worksheet (one per student)
 - “Without Impact Rubric” (one per student)
- Print one copy for each group of students (and an additional copy for the teacher to display) of the trail and road map of Great Smoky Mountains National Park (see source suggestions under “Materials”).
- For Session 1, gather calculators, rulers and graph paper.
- For Sessions 2 and 3:
 - Reserve time in the computer lab or arrange for a classroom set of computers.
 - Gather scissors, clear tape, rubber bands, twine and colored pencils.
 - Cut six 24-inch pieces of twine.
 - Create a class blog online or prepare a school-wide bulletin board for “Without Impact” projects.



Contact Without Impact



GROUPINGS

- Whole group
- Small groups
- Pairs
- Individual work



CLASS TIME

Four 45- to 60-minute sessions, total 3 to 4 hours



CONNECTIONS

- Science
- Technology
- Language Arts
- Mathematics



NATIONAL STANDARDS/COMMON CORE

- (NS) Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. (NSTA Science: Human Impacts)
- (NS) Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. (NETS Research and Information Fluency)
- (CC) Language Arts, Writing W.9-12.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.



TERMS AND CONCEPTS

- | | | |
|--------------------|-------------------|------------------|
| • Quarter | • Obverse (front) | • Reverse (back) |
| • Mileage | • Literal | • Figurative |
| • Carbon footprint | • Biodegradable | |



BACKGROUND KNOWLEDGE

Students should have a basic knowledge of:

- Digital citizenship
- Environmental issues



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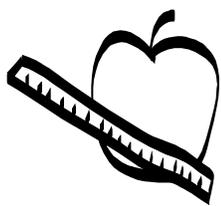
- Geographic representation
- Spatial thinking skills
- Mathematical formulas
- Miles per hour (mph)
- Miles per gallon (mpg)
- Map skills



STEPS

Session 1

1. Display and examine the “Great Smoky Mountains National Park Quarter” page. Locate this site on a class map. Note its position in relation to your school’s location.
2. As background information, explain to the students that the United States Mint began to issue the quarters in the America the Beautiful Quarters® Program in 2010. By the time the program ends in 2021, there will be a total of 56 quarter designs. Each design will focus on a different national site—one from each state, territory and the District of Columbia.
3. Tell the students that the front of a coin is called the “obverse” and the back is called the “reverse.” Discuss the image on the quarter’s reverse with the students. This design depicts a historic log cabin found within Great Smoky Mountains National Park, a segment of the lush green forest and a hawk circling above. The Park boasts one of the few remaining old growth forests in North America. No other area of equal size in a temperate climate can match the park’s amazing diversity, with more than 17,000 species of plants, animals and invertebrates documented in the park.
4. Ask the students to predict how long it would take a hawk to fly from the middle of the park to your school’s location by first estimating the distance. Distribute calculators to the class if available. Use the class map of the United States and write estimates of the distance on chart paper.
5. Using online resources, verify the distance. If the distance does not match the estimate, recalculate the distance.
6. Tell the students that the red-tailed hawk in migration flies at an average of 30 miles per hour. Guide the students through calculating the time it would take the hawk.
7. Lead the students in a discussion about this journey, ending by incorporating all the factors that might affect the time calculation, such as the hawk’s energy consumption, ability to find food or water, weather conditions and so on.

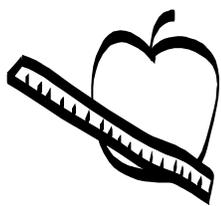


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8. Explain to the students that they will plan a route through the Great Smoky Mountains National Park to visit historic buildings, such as the log cabin on the coin image. Explain that they will both measure and estimate distance and time using traditional maps and calculators.
9. Discuss the title of the lesson, “Contact Without Impact.”
10. To introduce and define the terms “footprint,” literal” and “figurative,” draw a T-chart on chart paper titled “Footprint” and label the columns “Literal” and “Figurative.” Define the term “literal” to mean an expression that is plain or common. Define the term “figurative” to mean an expression that uses a metaphor or other descriptive language, especially for abstract ideas.
11. Use the expression “keep both feet on the ground” as a discussion point. Explain to the students that literally this means exactly what it says, but figuratively it means to be practical and level-headed. Lead the students in a discussion comparing other examples that are figurative or literal.
12. Ask the students in which columns the verbs “measure” and “estimate” would best fit on the T-chart.
13. Ask the students to give several examples of a footprint. Answers should include carbon footprint and the area on which a building is positioned.
14. Distribute a copy of the “Footprints” worksheet, the “Contact Patches” worksheet, a ruler and a piece of graph paper to each student. Review the worksheet directions with the students. Allow time for the students to complete the worksheets.

Session 2

1. Review the charts and worksheet from the previous session. Display the “Great Smoky Mountains National Park Quarter” page. Lead the students in a discussion ranking the impacts of a hawk, a human, a car or a log cabin on the environment.
2. Direct the students to a Web site that gives information about the history of the Great Smoky Mountains National Park (see suggestions under “Materials”). Ask the students to locate information about how this area became a National Park. Note that this is the most visited national park in the United States.
3. Divide the class into six groups and assign a number from 1 to 6 to each group.
4. Distribute a copy of the “Contact Planner” worksheet to each student. Identify the starting point for each group as the location number that corresponds with their group number. Have the students assign roles within the group as listed on the worksheet. Answer any questions students have about the task.
5. Distribute to each group one set of an enlarged trail and road map of the Great Smoky Mountains.

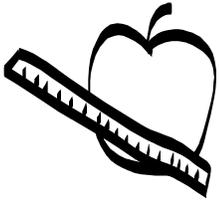


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6. Distribute three differently colored pencils, a piece of twine and rulers to each group. Demonstrate using twine to measure curving roads.
7. Discuss the map's legend and review how to use geographical representations by demonstrating the use of grid location, directions and mileage.
8. Provide the students with Web site addresses where they can access maps on the Internet. Allow time for the students to route their journeys using paper and Internet maps and to complete the "Contact Planner" worksheet.
9. Prepare for the next session by collecting the materials and rolling up the maps. Assess each group's progress in reading and marking their maps.
10. Have the students create a list of what the visitors might be leaving behind and using during their visits to the park.

Sessions 3 and 4

1. Display the "Great Smoky Mountains National Park Quarter" page. Lead the students in a discussion comparing the impact of log cabin households with households today. Make a T-chart on chart paper, labeling the columns "Biodegradable" and "Non-biodegradable." List student observations.
2. Discuss and define the vocabulary term "biodegradable" as the ability of an item to decay. Ask the students to give examples of items that decay and items that do not decay.
3. Prompt the students to complete the T-chart with biodegradable and non-biodegradable items.
4. Direct the students back to the park Web site and have them locate information on environmental factors. Distribute sticky notes and have each student summarize one environmental concern on the note.
5. Distribute the "Without Impact" rubric. Have the students use the suggested Web sites that provide information about calculating or minimizing our carbon footprint to research one or more ways to reduce the impact of visitors.
6. Have the students apply this information to the specific environmental problem from step 4. Direct the students to the class blog or the bulletin board. Have the students write persuasive essays that inspire positive action to reduce environmental impacts in the Great Smoky Mountains National Park.
7. Have the students contribute these suggestions to the class blog or school-wide bulletin board. Allow time for exploring environmental issues or to finish the mapping project.
8. Have the students read the blog or bulletin board and add constructive comments that agree or disagree or contribute more information.



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ASSESSMENTS

- Take anecdotal notes on class participation.
- Use the worksheets and rubric to assess whether the students have met the lesson objectives.



ENRICHMENTS/EXTENSIONS

- Have the students complete a carbon footprint calculator based on their household.
- Have the students conduct differentiated book study groups with texts that describe the lives and impacts of people who lived in the Great Smoky Mountains region, such as:
 - *The Jack Tales* by Richard Chase
 - *Where the Lilies Bloom* by Vera and Bill Cleaver
 - *That Book Woman* by Heather Henson and David Small
 - *The Rag Coat* by Lauren Mills
- Have the students calculate the perimeter and area of park hiking loops.
- Have the students re-route their visits within the park using historical maps from the Web sites suggested in Materials and post these journeys on a chronological timeline.
- Instead of using the contact patches provided, allow students to make and measure their own contact patch.



DIFFERENTIATED LEARNING OPTIONS

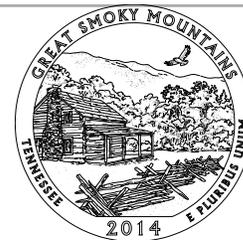
- Work in pairs.
- Provide fill-in-the-blank step-by-step instructions for the “Footprints” worksheet.
- Demonstrate in small groups how to measure the first distance between locations, then check for understanding by allowing the student to do the rest. Repeat for each different type of journey.



Name _____

Footprints

Directions: Sketch the outlines of the footprints of a log cabin, a car, a human and a hawk. The formula to calculate a rectangular area is $\text{area} = \text{length} \times \text{width}$. Footprints with irregular or rounded areas will be estimates based on a rectangular area. If the area is an estimate, write the word "estimate."



Log Cabin: The width of the cabin is 22 feet. The length of the cabin is 28 feet.

Vehicle: Measure the rectangle of the contact patch that touches the road using one of the examples on the "Contact Patches" worksheet. Multiply by the number of wheels.

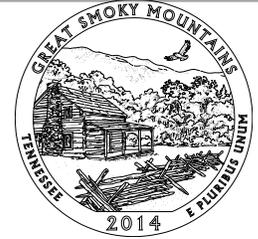
Human feet: Trace your foot on a piece of graph paper, then draw a rectangle around the outline and calculate area based on the width and length. Multiply the answer by 2 and write the answer here.

Hawk: The foot has 3 toes in front and one in back. Each toe is about 3 inches long, including the talon. The toes are about 1/2 inch thick. Multiply by 2.



Name _____

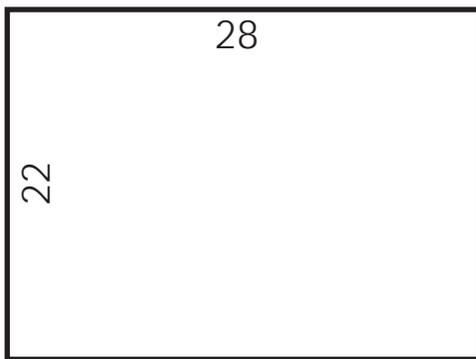
Footprints Key



Directions: Sketch the outlines of the footprints of a log cabin, a car, a human and a hawk. The formula to calculate a rectangular area is area = length x width. Footprints with irregular or rounded areas will be estimates based on a rectangular area. If the area is an estimate, write the word "estimate."

Log Cabin: The width of the cabin is 22 feet.
The length of the cabin is 28 feet.

$$22 \times 28 = 616 \text{ square feet}$$



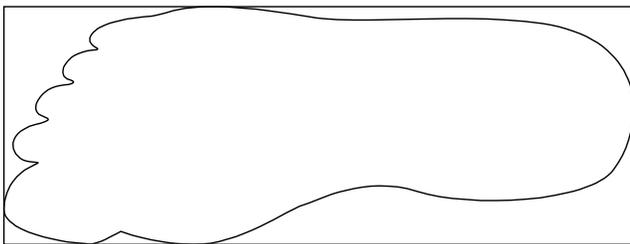
Vehicle: Measure the rectangle of the contact patch that touches the road. Multiply by the number of wheels.

$$\begin{aligned} \text{Car tire: } & 5.5 \text{ by } 6 \text{ inches} = 33 \text{ sq. in.} \\ & 33 \times 4 \text{ tires} = 132 \text{ sq. in.} \end{aligned}$$

$$\begin{aligned} \text{Bicycle tire: } & .25 \text{ by } 3.25 \text{ inches} = .8125 \\ & .8125 \times 2 \text{ tires} = 1.625 \text{ sq. in.} \end{aligned}$$

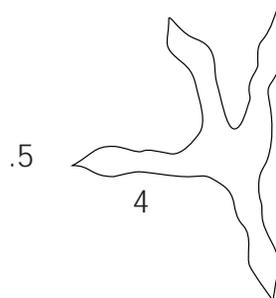
Human feet: Trace your foot on a piece of graph paper, then draw a rectangle around the outline and calculate area based on the width and length. Multiply the answer by 2 and write the answer here.

Answers will vary by foot size.
"Estimate" is written.



Hawk: The foot has 3 toes in front and one in back. Each toe is about 3 inches long, including the talon. The toes are about 1/2 inch thick. Multiply by 2.

$$\begin{aligned} 4 \text{ toes} \times 3 \text{ inches} &= 12 \text{ inches} \\ 12 \times .5 \text{ inch thick} &= 6 \text{ square in.} \\ 6 \times 2 \text{ feet} &= 12 \text{ square inches} \\ \text{"Estimate" is written.} \end{aligned}$$





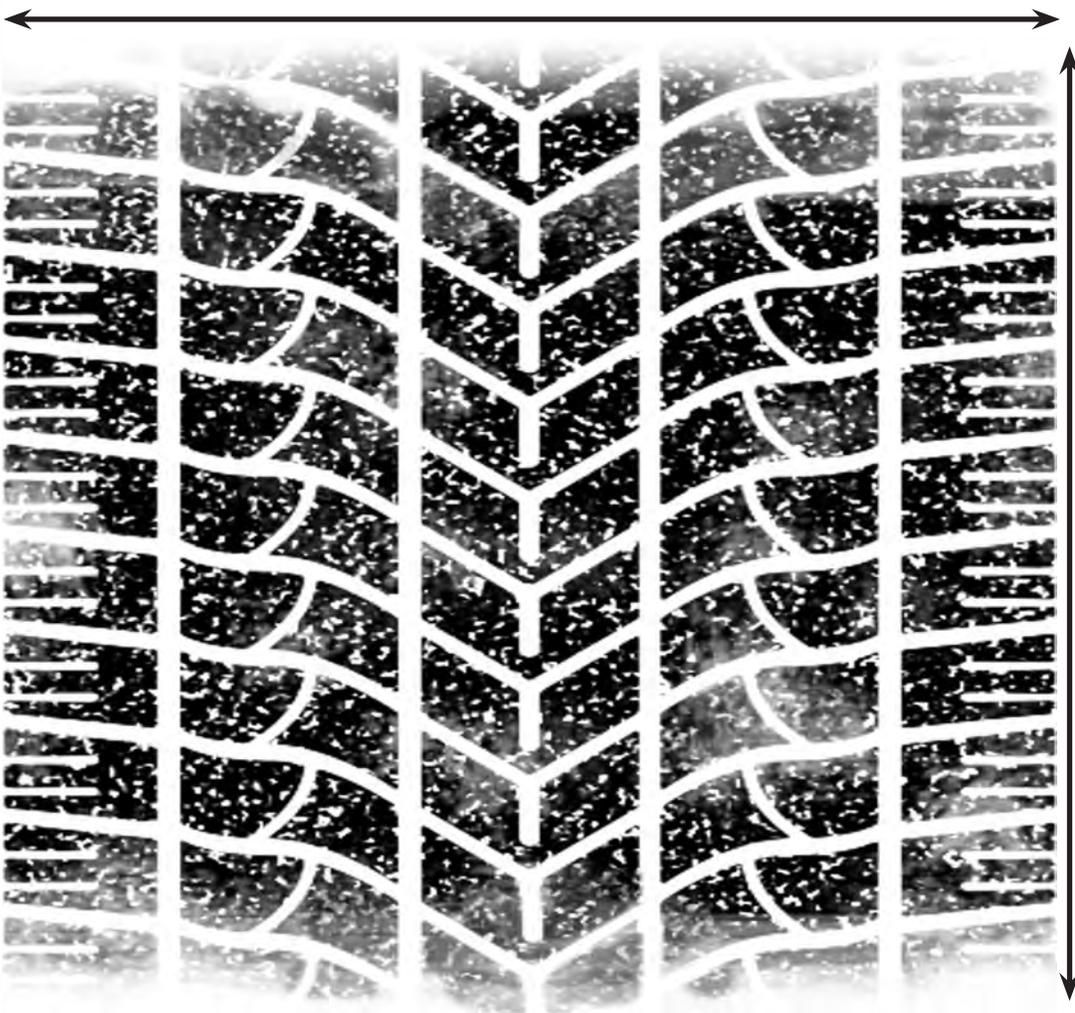
Name _____

Contact Patches

Directions: Measure the contact patch below that you would like to use for the "Footprints" worksheet and write the measurements in the appropriate places.



Car Tire



Bicycle Tire





Name _____

Contact Planner

Job	Name
Leader/Liaison	
Internet Reader	
Internet Map	
Paper Map	
Calculator	
Scribe	

Directions: Choose four of the six areas below to visit, then route your journey efficiently through the park.

- | | | |
|----------------|------------------------------------|------------------------------|
| 1. Cades Cove | 2. Cataloochee | 3. Newfound Gap |
| 4. Oconaluftee | 5. Roaring Fork Motor Nature Trail | 6. Sugarlands Visitor Center |

To find your starting point, match your group number to the location above. Find the distance and travel time between each destination by three methods of travel using the map and Web sites provided. Mark each journey with a different colored pencil. Use the back of this paper as scratch paper for notes. Then answer the questions below.

Location	Hawk (30 mph)	Hike (3 mph)	Auto (35 mph)
Total Miles			

1. If your car's MPG is 18, how many gallons of gas will you need for the whole trip?
2. If your car's MPG is 35, how many gallons of gas will you need?
3. How much water will be consumed if each person drinks 8 ounces per hour?



Name _____

Contact Planner

Key

Job	Name
Leader/Liaison	
Internet Reader	
Internet Map	
Paper Map	
Calculator	
Scribe	

Directions: Choose four of the six areas below to visit, then route your journey efficiently through the park.

1. Cades Cove
2. Cataloochee
3. Newfound Gap
4. Oconaluftee
5. Roaring Fork Motor Nature Trail
6. Sugarlands Visitor Center

To find your starting point, match your group number to the location above. Find the distance and travel time between each destination by three methods of travel using the map and Web sites provided. Mark each journey with a different colored pencil. Use the back of this paper as scratch paper for notes. Then answer the questions below.

• **Hawk Distances Rounded to Nearest Mile**

Location	Cades Cove	Cataloochee	Newfound Gap	Oconaluftee	Roaring Fork
Cataloochee	43				
Newfound Gap	24	19			
Oconaluftee	31	15	10		
Roaring Fork	22	25	9	18	
Sugarlands	18	26	8	18	3

- **Hike:** Answers may vary. Students may choose multiple routes to reach other destinations. Overall journey should not double back on itself, but be as efficient and straightforward as possible. Students should have a total number of miles hiking divided by a walking speed of 3 mph. Water consumption should equal the number of students in the group multiplied by 8 ounces (1 cup) per hour.
- **Auto:** Answers may vary. Students may choose multiple routes to reach other destinations. Overall journey should not double back on itself, but be as efficient and straightforward as possible. Students should have a total number of miles driving divided by a driving speed of 35 mph. Gallons of gas will equal number of hours multiplied by 18 and then 35. Note that the park Web site frequently lists both driving and hiking distances for popular loops and between locations.

1. If your car's MPG is 18, how many gallons of gas will you need for the whole trip? Answers will vary.
2. If your car's MPG is 35, how many gallons of gas will you need? Answers will vary.
3. How much water will be consumed if each person drinks 8 ounces per hour? Answers will vary.



Name _____

Without Impact

Directions: Write a persuasive essay to persuade a visitor to make contact without impact on the Great Smoky Mountains National Park. Use these and other Web sites to guide you:

- Student's Guide to Global Climate Change at www.epa.gov/climatechange/students
- My Trip Calculator at www.fueleconomy.gov/trip
- Climate Friendly Parks at www.nps.gov/grsm/naturescience/climate-friendly-park.htm
- Protecting What We Enjoy at www.sierrawild.gov/resources/lnt

Category	4	3	2	1	Self	Teacher
Content	Connects Great Smoky with outside Web site	Covers Great Smoky and outside Web site, but does not connect them	Covers either Great Smoky or outside Web site	Some material was copied and posted		
Realistic Tips	3 or more, specific, measurable and possible	2 tips, specific, measurable, and possible	Some tips not specific, measurable, or possible	1 tip, or not specific, measurable, or possible		
Accuracy	Would lead to carbon footprint reduction	Marginally specific to carbon footprint reduction	Not specific to carbon footprint reduction	Not good for environment		
Grammar	No errors	One to two errors	Three to five errors	Six or more errors		
Citation	Web site name and functional link	Name and link, but link did not work	Name or link, not both	Citation incorrect		

Total Points

Student Reflection

Teacher Comments



Shenandoah National Park Quarter



The United States of America

