



ENVIRONMENTAL SCIENCE

Merit Badge Requirements

1) Make a timeline of the history of environmental science in America. Identify the contribution made by the Boy Scouts of America to environmental science. Include dates, names of people or organizations, and important events.

2) Define the following terms: population, community, ecosystem, biosphere, symbiosis, niche, habitat, conservation, threatened species, endangered species, extinction, pollution prevention, brownfield, ozone, watershed, airshed, nonpoint source, hybrid vehicle, fuel cell.

3) Do ONE activity in EACH of the following categories (using the activities in this {the merit badge} pamphlet as the bases for planning and carrying out your projects):

A) *Ecology*

- 1) Conduct an experiment to find out how living things respond to changes in their environments. Discuss your observations with your counselor.
- 2) Conduct an experiment illustrating the greenhouse effect. Keep a journal of your data and observations. Discuss your conclusions with your counselor.
- 3) Discuss what is an ecosystem. Tell how it is maintained in nature and how it survives.

B) *Air Pollution*

- 1) Perform an experiment to test for particulates that contribute to air pollution. Discuss your findings with your counselor.
- 2) Record the trips taken, mileage, and fuel consumption of a family car for seven days, and calculate how many miles per gallon the car gets. Determine whether any trips could have been combined ("chained") rather than taken out and back. Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.
- 3) Explain what is acid rain. In your explanation, tell how it affects plants and the environment and the steps society can take to help reduce its effects.

C) *Water Pollution*

- 1) Conduct an experiment to show how living things react to thermal pollution. Discuss your observations with your counselor.
- 2) Conduct an experiment to identify the methods that could be used to mediate (reduce) the effects of an oil spill on waterfowl. Discuss your results with your counselor.
- 3) Describe the impact of a waterborne pollutant on an aquatic community. Write a 100-word report on how that pollutant affected aquatic life, what the effect was, and whether the effect is linked to biomagnification.

D) *Land Pollution*

- 1) Conduct an experiment to illustrate soil erosion by water. Take photographs or make a drawing of the soil before and after your experiment, and make a poster showing your results. Present your poster to your patrol or troop.
- 2) Perform an experiment to determine the effect of an oil spill on land. Discuss your conclusions with your counselor.
- 3) Photograph an area affected by erosion. Share your photographs with your counselor and discuss why the area has eroded and what might be done to help alleviate the erosion.

**Requirements continued on next page

E) Endangered Species

- 1) Do research on one endangered species found in your state. Find out what its natural habitat is, why it is endangered, what is being done to preserve it, and how many individual organisms are left in the wild. Prepare a 100-word report about the organism, including a drawing. Present your report to your patrol or troop.
- 2) Do research on one species that was endangered or threatened but which has now recovered. Find out how the organism recovered, and what its new status is. Write a 100-word report on the species and discuss it with your counselor.
- 3) With your parent's and counselor's approval, work with a natural resource professional to identify two projects that have been approved to improve the habitat for a threatened or endangered species in your area. Visit the site of one of these projects and report on what you saw.

F) Pollution Prevention, Resource Recovery, and Conservation

- 1) Look around your home and determine 10 ways your family can help reduce pollution. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.
 - 2) Determine 10 ways to conserve resources or use resources more efficiently in your home, at school, or at camp. Practice at least two of these methods for seven days and discuss with your counselor what you have learned.
 - 3) Perform an experiment on packaging materials to find out which ones are biodegradable. Discuss your conclusions with your counselor.
- 4) Choose two outdoor study areas that are very different from one another (e.g., hilltop vs. bottom of a hill; field vs. forest; swamp vs. dry land). For BOTH study areas, do ONE of the following:
- A) Mark off a plot of 4 square yards in each study area, and count the number of species found there. Estimate how much space is occupied by each plant species and the type and number of nonplant species you find. Write a report that adequately discusses the biodiversity and population density of these study areas. Discuss your report with your counselor.
 - B) Make at least three visits to each of the two study areas (for a total of six visits), staying for at least 20 minutes each time, to observe the living and nonliving parts of the ecosystem. Space each visit far enough apart that there are readily apparent differences in the observations. Keep a journal that includes the differences you observe. Then, write a short report that adequately addresses your observations, including how the differences of the study areas might relate to the differences noted, and discuss this with your counselor.
- 5) Using the construction project provided or a plan you create on your own, identify the items that would need to be included in an environmental impact statement for the project planned.
- 6) Find out about three career opportunities in environmental science. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Requirement 1

Use this area to make a timeline of the history of environmental science in America.

Identify the contribution made by the Boy Scouts of America to environmental science. Include dates, names of people or organizations, and important events: _____

Requirement 2

Describe the following terms:

Population: _____

Community: _____

Ecosystem: _____

Biosphere: _____

Symbiosis: _____

Niche: _____

Habitat: _____

Conservation: _____

Threatened Species: _____

Endangered Species: _____

Extinction: _____

Scout Name: _____ Unit #: _____ Date: _____

Pollution Prevention: _____

Brownfield: _____

Ozone: _____

Watershed: _____

Airshed: _____

Nonpoint Source: _____

Hybrid Vehicle: _____

Fuel Cell: _____

Requirement 3

You have been given six categories. For each category there are three options. Select and complete ONE option from EACH category.

Use the activities in the Environmental Science merit badge pamphlet as the bases for planning and carrying out your projects. Briefly describe below each of the activities you did. Keep all your paperwork, notes and activity materials that you used for your experiments and studies and show them to your counselor.

A: Ecology

If you selected ***Option A1***:

Conduct and experiment to find out how living things respond to changes in their environments. After conducting your experiment use this area to briefly describe your experiment and the results: _____

If you selected ***Option A2***:

Conduct and experiment illustrating the greenhouse effect. After conducting your experiment use this area to briefly describe your experiment and the results. _____

Scout Name: _____ Unit #: _____ Date: _____

If you selected **Option A3**:

What is an ecosystem? _____

How is an ecosystem maintained in nature and how does it survive? _____

B: Air Pollution

If you selected **Option B1**:

Perform an experiment to test for particulates that contribute to air pollution. After conducting your experiment use this area to briefly describe your experiment and the results: _____

If you selected **Option B2**:

*At the back of this worksheet there is a worksheet you may use (but don't have to) to help you gather information for this requirement.

Record the trips taken, mileage, and fuel consumption of a family car for seven days, and calculate how many miles per gallon the car gets. Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.

How many miles per gallon does your car get? _____

Look at your log of trips taken.

Were there any trips that could have been combined ("chained") rather than taken out and back? _____

Using the idea of trip chaining, determine how many miles and gallons of gas could have been saved in those seven days.

Miles that could have been saved: _____ Gallons of gas that could have been saved: _____

If you selected **Option B3**:

What is acid rain? _____

How does it affect plants and the environment? _____

What steps can society take to help reduce the effects of acid rain? _____

D: Land Pollution

If you selected **Option D1**:

Conduct an experiment to illustrate soil erosion by water. After you have conducted the experiment use this area to briefly describe your experiment and the results. _____

Take photographs or make a drawing of the soil before and after your experiment, and make a poster showing your results. Give a brief summary of the before and after photos or drawings: _____

___ Show your poster to your counselor and your patrol or troop.

If you selected **Option D2**:

Perform an experiment determining the effect of an oil spill on land. Give a brief summary of the experiment and the results. Share your conclusions with your counselor. _____

If you selected **Option D3**:

Photograph an area affected by erosion. Share your photographs with your counselor.

Tell why the area has eroded: _____

What might be done to help alleviate the erosion? _____

Scout Name: _____ Unit #: _____ Date: _____

E: Endangered Species

If you selected ***Option E1***:

Do research on one endangered species found in your state.

What endangered species did you select? _____

What is its natural habitat? _____

Why is it endangered? _____

What is being done to preserve it? _____

How many of these organisms are left in the wild? _____

___ On a separate piece of paper, prepare a 100-word report about the organism, including a drawing or photo. Attach your report and picture to this worksheet.

___ Present your report to your patrol or troop.

If you selected ***Option E2***:

Do research on one species that was endangered or threatened but which has now recovered.

What organism did you select for this option that is no longer an endangered species? _____

How did this organism recover from being endangered? _____

What is the new status of this organism? _____

___ On a separate piece of paper, prepare a 100-word report about the organism, including a drawing or photo. Attach your report and picture to this worksheet.

___ Present your report to your patrol or troop.

If you selected ***Option E3***:

With your parent's and counselor's approval, work with a natural resource professional to identify two projects that have been approved to improve the habitat for a threatened or endangered species in your area. What 2 projects did you identify?

Project 1: _____ Project 2: _____

Visit the site of one of these projects and report on what you saw: _____

F: Pollution Prevention, Resource Recovery, and Conservation

If you selected **Option F1**:

Look around your home and determine 10 ways your family can help reduce pollution:

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

Practice two of these methods for seven days.

Tell what you have learned: _____

If you selected **Option F2**:

Determine 10 ways to conserve resources or use resources more efficiently in your home, at school, or at camp.

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____
- 9) _____
- 10) _____

Scout Name: _____ Unit #: _____ Date: _____

Practice two of these methods for seven days.

Tell what you have learned: _____

If you selected *Option F3*:

Perform an experiment on packaging material to find out which ones are biodegradable. Give a brief summary of your experiment and the results. Discuss this with your counselor. _____

Requirement 4

For this requirement you are required to select TWO outdoor areas, that are very different from each other, to study.

Once you have selected the two areas that you will study you have two options to choose from for this requirement. Select and complete one of them.

If you selected *Option A*:

Mark off two study plots of four square yards, and count the number of species found there.

Plot 1: Number of species found: _____

List each species below and list your estimation of how much space is occupied by each species found in the plots:

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Species: _____ Space Used: _____ Species: _____ Space Used: _____

Scout Name: _____ Unit #: _____ Date: _____

Plot 2: Number of species found: _____

List each species below and list your estimation of how much space is occupied by each species found in the plots:

Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____
Species: _____	Space Used: _____	Species: _____	Space Used: _____

Tell the type and number of nonplant species you find on your plots:

Plot 1:

Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____

Plot 2:

Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____
Type: _____	# _____	Type: _____	# _____

If you selected **Option B**:

Make at least three visits to each of the study areas, staying for at least 20 minutes each time, to observe the living and nonliving parts of the ecosystem. Space each visit far enough apart that there are readily apparent differences in the observations. Use this area to take notes during each of your three visits. In your notes you will want to include such items as the time of day, weather conditions, temperature, any activity you see, and any differences to the study area since your last visit. Compile your notes into a journal.

Plot 1

1st Visit: _____

2nd Visit: _____

3rd Visit: _____

Worksheet for Requirement 3B2

Use this area to help you gather data needed for requirement 3 B2. Here is an example of how you could use this area:

Date: 1/1/06 Odometer: 158102 Miles: Gallons: 13.243 MPG: \$ /Fill: \$39.58 \$/Gal: \$2.99
 Date: 1/1/06 Odometer: 158410 Miles: 308 Gallons: 21.471 MPG: 14.35 \$ /Fill: \$66.12 \$/Gal: \$3.08
 Date: 1/1/06 Odometer: 158678 Miles: 268 Gallons: 19.973 MPG: 13.42 \$ /Fill: \$65.89 \$/Gal: \$3.30

From this data we find the following:

Average MPG = 13.89 Minimum MPG = 13.42 Maximum MPG = 14.35

Average Cost Per Mile = \$0.22

Total Fuel Cost = \$171.59

Average Cost Per Gallon = \$3.12

Total Gallons = \$54.69

Total Miles Driven = 576.3

Gather your data for the 7 days required. After you have gathered the data, have your parents or leader help you figure out the totals.

Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____
Date: _____	Odometer: _____	Miles: _____	Gallons: _____	MPG: _____	\$ /Fill: _____	\$/Gal: _____

Total Miles Driven = _____ Total Gallons = _____ Total Cost of Fuel = \$ _____

Average MPG = _____