

# Note to Educators

The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. For more than 100 years, our motto has been caring for the land and serving people. The Forest Service, U.S. Department of Agriculture (USDA), recognizes its responsibility to be engaged in efforts to connect youth to nature and to promote the development of science-based conservation education programs and materials nationwide.

This Ecosystem Services edition of the *Natural Inquirer* combines research done by the Forest Service and the USGS (U.S. Geological Survey). The mission of the USGS is that of serving the Nation by providing reliable scientific information to describe and understand Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

The *Natural Inquirer* is a science education resource journal to be used with learners from grade 5 and up. The *Natural Inquirer* contains articles describing environmental and natural resource research conducted by Forest Service and USGS scientists and their cooperators. These are scientific journal articles that have been reformatted to meet the needs of middle school students. The articles are easy to understand, are aesthetically pleasing to the eye, contain glossaries, and include hands-on activities. The goal of the *Natural Inquirer* is to stimulate critical reading and thinking about scientific inquiry and investigation while learning about ecology, the natural environment, and natural resources. In this edition of the *Natural Inquirer*, you will find four articles on ecosystems written in the scientific method format.

## The Format of a *Natural Inquirer* Article:

Each *Natural Inquirer* article follows the same format. *Natural Inquirer* articles are written directly from a published science article, and all have been reviewed by the scientists for accuracy. Each article contains



the following sections, which you may introduce to your students as they read:

### **Meet the Scientists:**

Introduces students to the scientists who did the research. This section may be used in a discussion of careers in science.

### **Glossary:**

Introduces possibly new scientific or other terms to students. The first occurrence of a glossary word is bold in the text.

### **Thinking About Science:**

Introduces something new about the scientific process, such as a scientific habit of mind or procedures used in scientific studies.

### **Thinking About the Environment:**

Introduces the environmental topic being addressed in the research.

### **Introduction:**

Introduces the problem or question being addressed by the research.

### **Method:**

Describes the method used by the scientists to collect and analyze their data.

### **Findings:**

Describes the results of the analysis.

### **Discussion:**

Discusses the findings and places them into the context of the original problem or question.

### **Citation:**

Gives the original article citation with a Web link to the original article.

### **Science Education Standards and Evaluations:**

In the back of the journal, you will find a matrix that enables you to identify articles by the national science education standards that they address. Evaluation

forms for both educators and students are available on our Web site. We welcome any feedback so please visit <http://www.naturalinquirer.org> and complete the online evaluation forms. Additionally, you may contact Dr. Barbara McDonald at the address below with any comments you have.

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(Please put “Educator Feedback” in the subject line)

### **Educator Resources:**

Visit the updated *Natural Inquirer* Web site at <http://www.naturalinquirer.org>. From this site, you can read and download lesson plans, word games, and other resources to help you use the *Natural Inquirer* in your classroom. You can also view and download a yearlong lesson plan aimed at helping your students learn about the scientific process.

Visit the *Natural Inquirer* Web site at <http://www.naturalinquirer.org>.

## Lesson Plan for Ecosystem Services Edition

### **Materials and Supplies:**

- *Natural Inquirer* Ecosystem Services Edition
- Copies of graphic organizer

### **National Science Education Standards Addressed: Content Standards A, C, F**

- A. Abilities Necessary To Do Scientific Thinking
- A. Understanding About Scientific Inquiry
- C. Structure and Function in Living Systems
- C. Regulation and Behavior
- C. Populations and Ecosystems
- G. Science as a Human Endeavor
- G. Nature of Science

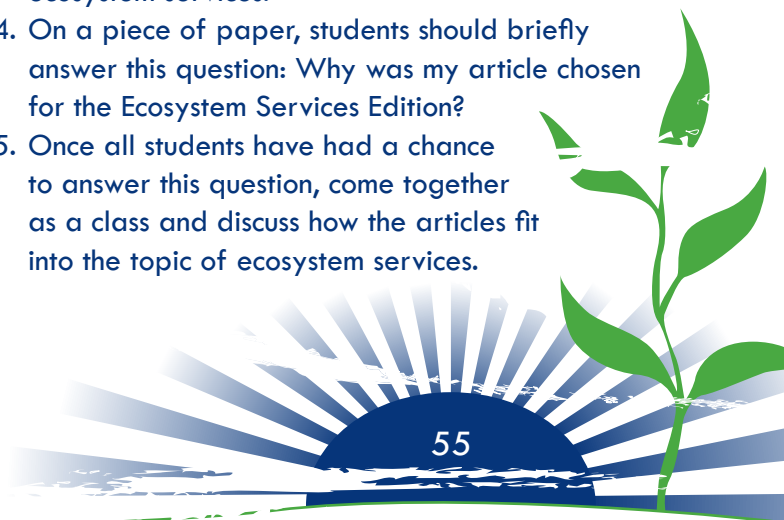
**Time Needed:** Two class periods

### **Class Period 1:**

1. Pass out the Ecosystem Services Edition of the *Natural Inquirer*. As a class, read the “Welcome to the Ecosystem Services Edition” and preview the table of contents.
2. Divide students into four groups and assign each group one article. (If you prefer smaller groups, divide students into eight groups and two groups will be assigned to one article.)
3. Tell students that they are responsible for reading their article and completing the graphic organizer. Each person in the group is responsible for completing the graphic organizer. These graphic organizers will be used to present the article to the class the following class period.
4. Before students begin their assignment also share with them the rubric you will use to grade their work. Make sure students are clear about your expectations before they begin their work.
5. Give students the remainder of the class to read the article and fill out the graphic organizer.

### **Class Period 2:**

1. Ask students to get out their graphic organizers and get into their groups. Allow the students 10 minutes to review what they did yesterday within their groups and prepare to speak to the rest of the class.
2. Once students are prepared, have groups share what they learned from their article.
3. After students have finished sharing about their articles, ask students to go back to their groups and reread the “Welcome to the Ecosystem Services Edition.” While reading this section, ask students to think about how their article fits into the topic of ecosystem services.
4. On a piece of paper, students should briefly answer this question: Why was my article chosen for the Ecosystem Services Edition?
5. Once all students have had a chance to answer this question, come together as a class and discuss how the articles fit into the topic of ecosystem services.



# Natural Inquirer Ecosystem services Graphic Organizer

In one or two sentences summarize the main idea of each section listed below.

*Thinking About Science*

*Thinking About the Environment*

In one or two sentences summarize the main idea of each section listed below.

<i>Introduction</i>	
<i>Method</i>	
<i>Findings</i>	
<i>Discussion</i>	

# Rubric For Ecosystem services Edition

	Unsatisfactory 1	Needs Improvement 2	Satisfactory 3	Exemplary 4	Score
Graphic Organizer	Did not make attempt to fill out graphic organizer	Filled out half of the graphic organizer	Filled out most of the graphic organizer- missed only 1 section	Completed the graphic organizer	
Understanding of Material	Did not demonstrate understanding of material	Limited understanding demonstrated	Demonstrated understanding of material	Added extra evidence to show understanding of material	
Grammar/ Punctuation	More than 8 errors	4-8 errors	1-3 errors	No errors	
Final Question	Did not demonstrate understanding of material	Limited understanding demonstrated	Demonstrated understanding of material	Added extra evidence to show understanding of material	
Score					

## Optional Internet Lesson Plan

### Materials:

1. *Natural Inquirer* Ecosystem Services Edition
2. Access to the Internet

### Time needed: One class period

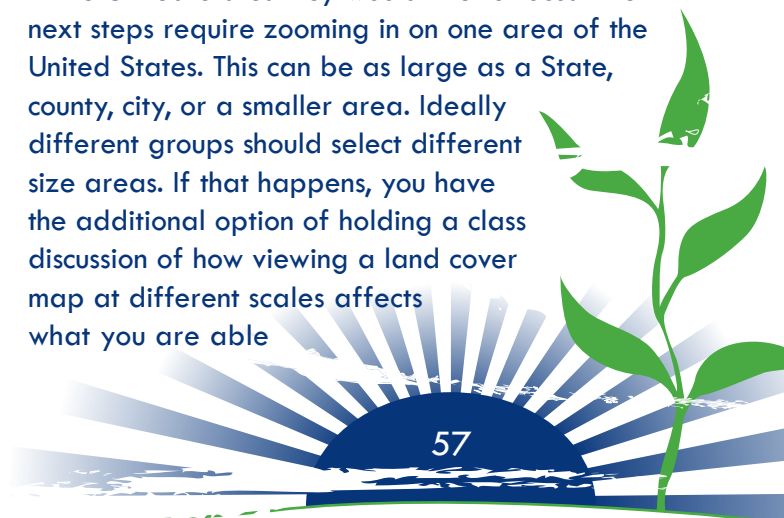
The purpose of this activity is to encourage students to critically think about how land cover, such as trees, water, pavement, and grasses, provides ecosystem services. The students will use an interactive map from the Internet to identify land cover and its associated ecosystem services anywhere in the United States.

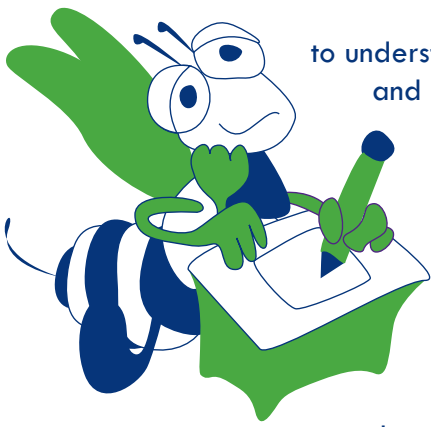
This activity works best if students are already familiar with ecosystem services. Review “Welcome to the Ecosystem Services Edition” and at least one of the following articles in the Ecosystem Services Edition: “Fill those potholes!” or “What goes around comes around.” Discuss the idea of ecosystem services with your students.

1. Have students form groups of three or four students each. Each group should have access to the Internet.

Go to <http://www.nationalatlas.gov> and click MAP MAKER. (Note: If you have only one computer available, do this exercise with the entire class.)

2. The screen should show a map of the United States. Students will access different features located on the right of the screen. First, add CITIES AND TOWNS and COUNTIES by clicking in the boxes by each. STATES should already be selected. Then click “redraw the map.” This tab is located on the top of the features box. After any item has been selected or deselected you must redraw the map to view the changes. Students should decide where in the United States they would like to focus. The next steps require zooming in on one area of the United States. This can be as large as a State, county, city, or a smaller area. Ideally different groups should select different size areas. If that happens, you have the additional option of holding a class discussion of how viewing a land cover map at different scales affects what you are able





to understand about land cover and ecosystem services.

3. Once students have chosen an area, it is best if they deselect (or unclick the boxes) CITIES AND TOWNS and COUNTIES. They can then redraw the map, and city, town, and county names will disappear. Now click “Basic maps” to close this option. Click the BIOLOGY feature. Below invasive species, find and click the box beside LAND COVER RESOLUTION 200 and redraw the map. The map should now show different colors that represent different land cover types in the area they have chosen to study. Click on BIOLOGY to close this option.
4. Have students click on WATER. Then click in the box beside STREAMS AND WATERBODIES. Close the water option. Students should again redraw their maps. Their screen will show a map of their area with all land cover categories color-coded, with streams and other water bodies visible.
5. Explain to students that land cover is the physical material at the surface of Earth. Land covers include grass, asphalt, trees, bare ground, water, etc. Each type of land cover has associated ecosystem services. Tell students that they will next think about what kind of ecosystem services are provided by the land cover and water within their map area.
6. Students need to be able to view the land cover key. To view the land cover key, click “map key” at the bottom of the map or in the top right tab. The land cover types and colors should be visible on the right.
7. Now the students are ready to explore the ecosystem services provided by the land cover types on their maps. Students may want to zoom

in closer by clicking on the location on the map. Students can zoom out by clicking the area on the top of the map that says “zoom out.”

8. Have students identify the different land covers and waters in their map area by using the map key and the ecosystem services key provided on page 59. Students should explore by discussing what kind of land cover (and water) is found on their map. Using the Ecosystem Services Key below, students should begin to list the possible ecosystem services provided by the area on their map. Students may have additional ideas about the ecosystem services provided by the area. Each person in the group should write a paragraph about the ecosystem services provided by the land cover on their map. Each student should select at least three ecosystem services about which to write. You may use the rubric located at the end of the lesson plan to assess each student’s progress with the activity.

As an option, once students have “drawn” their maps on the screen, they may print them by clicking “Print map” at the top. They should enter a map title and follow instructions to print.



# Ecosystem services Key

- 1. Water:** Water provides aquatic species habitat, food, and shelter. Water also provides drinking water for humans and animals and water for plants. People may use the waterways as a way to get from one place to another.
- 2. Perennial ice and snow:** Provides fresh water for plants and animals.
- 3. Low-intensity residential:** Provides edge habitat for birds, small mammals, and insects. Open areas maybe used by predators to find prey.
- 4. High-intensity residential:** Some insects and a few songbirds or other birds may be found in the area. Some small mammals may find shelter in houses or in other buildings.
- 5. Commercial/industrial/transportation:** A few birds may nest in the buildings or bridges.
- 6. Bare rock/sand/clay:** Different minerals come from each material. Some plants and animals only live on, under, or around rocks. Bare rock provides a place for reptiles to bask in the sun.
- 7. Quarries/strip mines/gravel pits:** Large pools of water can form in quarries after a rain and provide temporary water for animals.
- 8. Transitional:** This area provides food and shelter for many different types of animals.
- 9. Deciduous forest:** Provides food, shelter, and habitat for a wide variety of animals. Wood can be harvested to make homes and other products. Leaves fall to the ground and provide nutrients to the soil. Soil erosion is reduced in deciduous forests. Trees also take in and hold carbon, which reduces the amount of carbon dioxide in the atmosphere.
- 10. Evergreen forest:** Provides food, shelter, and habitat for animals. Cover is available to animals all year long. Wood can be harvested to make homes and other products. Trees also take in and hold carbon, which reduces the amount of carbon dioxide in the atmosphere.
- 11. Mixed forest:** Provides food, shelter, and habitat for animals. Some cover is available to animals all year long. Wood can be harvested to make homes and other products. Leaves fall to the ground and provide nutrients to the soil.
- 12. Shrubland:** Food, shelter, and habitat for animals. Soil erosion is reduced because plants hold the soil together.
- 13. Orchards and vineyards:** Insects and birds use the edge for shelter and look for food. Shelter is available for small mammals.
- 14. Grasslands/herbaceous:** Grazing habitat for different animals. Habitat for insects and small mammals. The plants reduce soil erosion.
- 15. Pasture/hay:** Grazing habitat for different animals. Habitat for insects and small mammals. The plants reduce soil erosion. People can use the hay for livestock and can sell the hay for money.
- 16. Row crops:** Insect and songbird habitat. A source of food for people. Some wild animals will also eat the crops.
- 17. Small grains:** Songbird, small mammals, and people food sources.
- 18. Fallow:** Habitat and food source for insects, songbirds, and mammals.
- 19. Urban/recreational grasses:** Insect and songbird habitat. Some small mammals may use this area for habitat.
- 20. Woody wetlands:** Great habitat for many different animals—ducks, amphibians, reptiles, and mammals. Many animals will use this area to raise their babies. Source of water for animals. Wetlands filter the water to keep it clean and to reduce flooding in the areas.
- 21. Emergent herbaceous wetlands:** Great habitat for many different animals—ducks, amphibians, reptiles, and mammals. Many mammals will eat the plants that grow in this area.



	Unsatisfactory 1	Needs Improvement 2	Satisfactory 3	Exemplary 4	Score
Map Maker	Did not make attempt to follow map directions	Filled out half of the map directions	Filled out most of the map directions- missed only 1 section	Completed the map directions	
Understanding of Material	Did not demonstrate understanding of material	Limited understanding demonstrated	Demonstrated understanding of material	Added extra evidence to show understanding of material	
Grammar/ Punctuation	More than 8 errors	4-8 errors	1-3 errors	No errors	
Final Question	Did not demonstrate understanding of material	Limited understanding demonstrated	Demonstrated understanding of material	Added extra evidence to show understanding of material	
Score					

Alternative: Students who have access to the Internet at home may be assigned this for homework. Go through the steps in class prior to making the assignment so students know what to do. You may want to make copies of the numbered instructions and the ecosystem services key for their reference. If you take this alternative, have students print their maps at home. Hold a class discussion the following day and have students share their maps and their paragraphs.



## Reflection Section Answer Guide

### Toad-ally Awesome!

#### Introduction

What was the question the scientists wanted to answer? *How does flooding affect the reproduction of toads in the forests along the Rio Grande?*

How do you think flooding affects the reproduction of toads? *This is an individual question and students should back up their opinions with logic, evidence, and reason.*

#### Method

Why did the scientists also measure the amount of rainfall and the amount of water flow at each of the sites? *The scientists needed to measure these things because the amount of rainfall and the amount of water flow help the scientists determine whether the area flooded or not.*

Why do you think the scientists conducted their experiment from June through September of each year? *This is an individual question. Possible answers*

