

Title: Ecology Explorers

Description: Our lives are intertwined with every other living thing on Earth. Students learn about this interdependence and research an endangered organism in their region. After mapping their understanding of threatened species using the *Seeing Reason Tool*, students propose practical as well as economically feasible solutions to ensure the survival of their species in the shadow of humankind.

At a Glance

Grade Level: 6-8

Subject sort (for Web site index): Science, Language Arts

Subject(s): Life Science, Writing

Topics: Ecology

Higher-Order Thinking Skills: Critical Thinking, Evaluation

Key Learnings: Interdependence, Endangered Species, Research Skills, Report Writing

Time Needed: Four weeks, 20-50 minutes each day

Unit Summary

Students study problems that arise as wildlife and human habitats increasingly overlap in our shrinking world. Taking the role of wildlife conservationists, students become experts on an endangered animal or plant that is at risk in their region. They study the organism's needs and understand interdependencies in the ecosystem in which it lives. Using the *Seeing Reason Tool*, students model their developing understanding of the intricacies of a balanced ecosystem, and then map the human factors that influence that balance. Through a Webquest research project, they learn how human activity affects an organism's survival and consider ways to lessen human impact on local populations. They prepare a presentation for an authentic audience in which they describe their species' habitat needs and offer practical and economically feasible solutions to ensure its continued existence.

Curriculum-Framing Questions

Essential Questions

How can we all get along?

Unit Questions

How can people and animals coexist?

What influences the biological success of a species?

Content Questions

What are limiting factors?

What are the organisms within an ecosystem and how are they dependent upon each other?

What makes a species endangered?

Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Ecology Explorers Unit Plan. These assessments help students and teachers set goals, monitor student progress, provide feedback, assess thinking, processes, performances, products, and reflect on learning throughout the instructional cycle.

Instructional Procedures

Prior to Instruction

In advance of instruction, prepare the materials for the introductory "balanced systems" investigation. In individual plastic bags (one set for every four students), include:

- 13 8-penny nails with flat heads (not finishing nails)
- 1 block of wood, approximately 10 cm by 4 cm, with one of the above nails embedded in the center

Provide science journals for each student to reflect on and respond to activities and questions throughout the unit.

Review the [Ecology Webquest](#). Make sure associated Web sites are active, and replace inactive sites if necessary. An alternative Webquest could be designed so that students research animals only from their local region, rather than worldwide—especially if you want the students to get involved in any community or regional action plans.

Consider how you could incorporate an authentic audience for your students' presentations. Contact local or state government officials, governing boards, wildlife specialists, community members, parent organizations, local clubs or organizations, etc. to set up a date and time when students can present their findings. If this is not possible, identify their audience as the (simulated) National Wildlife Conservation Board.

This unit makes use of the *Seeing Reason Tool*. Use these instructions for [setting up the two Seeing Reason projects](#) online.

Set the Stage

Pose the Essential Question, *How can we all get along?* Prompt students to think about this question related to world of science. Allow students time to write their thoughts in their science journals. Have students share their examples and thoughts in pairs. Turn the discussion back to the whole group and have individuals share what they've discussed. Chart student responses and save this chart to refer to throughout the unit. If some responses touch on ecosystems or other related topics, make sure to point out that this will be investigated further in the unit.

Begin the unit with an activity that focuses on the concept of balanced systems. Provide student teams with prepared sets of blocks and nails, and challenge them to create a "balanced" system by arranging the 12 loose nails so they all balance on the head of the one stationary nail that is embedded in the wood block. None of the loose nails can touch the wood or the ground. ([View balanced nails solution.](#))

Allow plenty of time for exploration, and assure students that there is at least one solution, if not more.

After students complete the challenge, lead a discussion about the ways the nail-balancing activity serves as a model for concepts that govern all systems, natural and manufactured. Reinforce the idea that parts of one system also interact with parts of other systems. Encourage thinking with questions such as:

- *What are the parts of this system?*
- *How does this system of nails balance? What forces and conditions influence this system?*
- *How do members of this system depend on other members?*
- *How many nails can be removed before the system fails and becomes unbalanced? What other actions could upset the balance?*

In the natural world, overlapping systems all work together to achieve a balanced ecosystem. Chemical, biological, and physical conditions all influence systems. Discuss examples, and ask:

- *What are some natural ecosystems? What features do they share?*
- *What parts of an ecosystem might the nails represent?*

- *What are some interactions and relationships between organisms in an ecosystem?*
- *How do natural ecosystems become unbalanced?*

Discuss the interdependence of life, and review food chains and food webs. You may want to have students draw food webs from different biomes (for example, desert food web, temperate forest food web) in their journals, and have them identify producers; primary, secondary, and tertiary consumers; and decomposers. Discuss symbiosis and symbiotic relationships: parasitism, mutualism, and commensalism. Refer to the [Ecology: Interdependence of Life \(PDF: 32 pages\)](#)* for an explanation of these concepts.

Explore Limiting Factors

Discuss the fundamental necessities of living things: food, water, shelter, and space in a suitable arrangement. Discuss how limiting factors (the availability of these necessities) influence animal and plant populations. Discuss how additional limiting factors, such as competition for resources, predation, and disease, also influence populations. To have students experience how changes in limiting factors change animal and plant populations, play *Oh Deer!* This simulation exercise is described at [Teachers.net Gazette](#)*, and available in print in the Arizona Game and Fish publication *Project Wild*. Afterward, discuss how limiting factors in play during the game affect food webs. Give student pairs the population data collected during the game. Have them enter it into a spreadsheet and then build animal population graphs. Ask students to explain why the fluctuations in population occur, using data from the game. View [limiting factors team sample](#). Once students have a good grasp of the concept of population fluctuations, pose the Content Question, *What makes a species endangered?* Have students discuss their ideas in small groups and then share their ideas with the whole group. Have students write about their ideas in their science journals and consider some initial answers to the Unit Question, *What influences the biological success of a species?*

Discuss Plant Ecology

In *Oh Deer!* and the activities relating to limiting factors, students focused on animals. Take time now to address plant ecology and the concept of succession, from initial colonizers to climax communities. Mention succession cycles due to short- and long-term natural events (fire, climatic change), but focus on how human actions influence succession.

Study Human-Wildlife Interaction

To explore and answer the Unit Questions, *How can people and animals coexist?*, assign students to teams of four. Introduce the [Ecology Webquest](#). Explain each section of the Webquest and their roles as wildlife conservationists. Hand out the [scoring guide](#) for students to self-monitor their progress as they move through the project.

Discuss how human and wildlife habitats overlap and how interactions in both rural and urban areas can influence wildlife as well as humans. Discuss human-wildlife interactions in your community, such as wild animals encroaching on populated areas or the effect of roads and fencing on animal migration patterns.

Have students use *Seeing Reason* to help them understand what happens when human and animal habitats overlap. Before they start mapping, follow these [steps to introduce Seeing Reason](#) to your class.

Have each group of four split into two teams. Have student teams log in to the *Seeing Reason* project, **Ecology Explorers: Overlapping Habitats** and map their response to the question, *What happens when human and animal habitats overlap?* Have students use the [Webquest links](#) to conduct research on this topic and provide evidence for their causal relationships. As students build their maps, circulate around the room. Look at maps, listen to conversations, and ask students to describe their map. Help students think through their map by asking questions such as:

- *What other factors relate to this one?*
- *What is your evidence for the relationship you show between these factors?*

Ask questions that prompt deeper thinking about the intricacies of the topic, such as:

- *Why are animal homes so important? How do animals that live in the forest depend on trees?*
- *How can an animal's success be affected by its direct or indirect interactions with humans?*
- *What do you think might be the long-term effects of these encounters on animal behaviors and social structures?*

When maps are complete, show several maps from the teacher workspace using a projector. Ask teams to describe their maps and the thinking behind them. After discussion, ask students to refine their maps based on what they learned from their peers.

The *Seeing Reason* space below represents one team's investigation in this project. The map you see is functional. You can roll over the arrows to read relationships between factors, and double-click on factors and arrows to read the team's descriptions.

Project Name: Ecology Explorers: Overlapping Habitats

Question: *What happens when human and animal habitats overlap?*

Have students write about their findings in their science journals and consider some initial answers to the Unit Question, *How can people and animals coexist?*

Review Research and Presentation Guidelines

Return to the [Webquest](#) and review the required tasks. Discuss the research and presentation assignment with the class, and teach necessary research skills, such as taking notes and citing references. Review the [research paper outline](#) and [scoring guide](#) to clarify expectations. Supply appropriate resources. You may need to help students locate specific statistics and other “buried” content in lengthy reports and understand how to read charts and tables. Encourage students to include interviews with people they may have contacted for information or opinions, such as ranchers, logging or mining company spokespeople, government officials, environmental groups, and people representing state wildlife organizations. Identify the audience for which each team is writing and/or presenting.

Create Causal Maps and Research Papers

Have students use the research paper outline and Webquest to guide them in conducting their research and planning the individual reports for their species. Ensure students engage in the writing processes of drafting, revision, peer review, and publishing. Students need to make sure their research applies to and can help them answer the Essential, Unit, and Content Questions.

As students are conducting research, have them share what they have learned regarding their endangered species within their group of four. Have them compare and identify similar situations that are affecting the various species they are reporting on. In groups of two, have student teams go to their *Seeing Reason* account and log on. They are to choose one of the two species they have researched—or they can choose both if they feel their species have similar issues—to construct a series of maps within the **Ecological Explorers: Species Success** project. Maps should address the following Unit Question, *What influences the biological success of your species?*

As students create their maps, take the opportunity to gauge understanding and guide learning. Look at maps, listen to conversations, and ask students to describe their maps. Ask questions that prompt deeper thinking about the intricacies of the topic, such as:

- *Can you compare the ways in which humans and animals have adapted to life in this habitat?*
- *In what ways might the presence of humans in this habitat affect animal behaviors?*

Have students work with each other during the mapping, research, and revision process. Arrange a “gallery walk,” where during several rotations, one partner in each team stays at the computer

to explain the team's map, while others rotate from computer to computer to view and ask questions about different teams' maps. Allow time for students to reconsider and fine-tune their maps after this activity.

The *Seeing Reason* space below represents one team's investigation in this project. The map you see is functional. You can roll over the arrows to read relationships between factors, and double-click on factors and arrows to read the team's descriptions.

Project Name: Ecology Explorers: Species Success

Question: *What influences the biological success of your specific species?*

Instruct students to use the information from their research and the creation of their map in the development of their research report and presentation on their group's species. Remind students to keep their targeted audience in mind as they research and write their report. Have students use the Webquest instructions, research paper outline, and the scoring guide to self- and peer-assess. Provide students a second revision phase after these assessments.

Create Presentations

When reports are finished, have student teams begin developing their oral presentations and supporting multimedia. Remind students that the different presentation formats may include Web page, multimedia presentation, poster, video, a play, or other approved visual format. Remind them they have the role of conservationists, and that the purpose of their presentation is to inform the wildlife conservation board (or other assigned audience) about the group's species and give viable, research-based solutions that will ensure the continued existence of all their species. Approve an outline of the presentation before students develop multimedia elements. Remind students to abide by copyright rules when using pictures or video in their presentations. Require peer-review prior to the oral presentation. [View a sample student slideshow presentation.](#)

Present Proposals

As students complete their presentations, finalize arrangements for an event where they present their proposals to the (simulated) National Wildlife Conservation Board or their authentic audience. You may want to ask civic leaders, wildlife specialists, and community members to represent this "board." Give students sufficient time to practice their presentations in small groups before they present to the larger audience. Assess student reports and presentations using the scoring guide and the details in the Webquest and research paper outline.

Wrap It Up

Revisit the Essential Question, *How can we all get along?* Refer back to the chart created at the beginning of the unit and review student ideas. Create a new chart with student responses and discuss how ideas have changed or stayed the same based on what they've learned in the unit. Post the Essential and Unit Questions and allow students to choose one or more of the questions to reflect upon. This question can be used as a portfolio piece or as part of unit reflection in their science journals.

Prerequisite Skills

None needed

Differentiated Instruction

Resource Student

- Narrow students' research focus by assigning specific topics to investigate. Some animal topics have more information available at a more basic level than others.
- Provide a report template with fill-in-the-blank topic sentences.
- Make heterogeneous groups so a variety of learning styles and abilities are represented in each group.

Gifted Student

- Require more in-depth research and analysis on all aspects of their project.
- Add an interview with an expert to the research requirements.

English Language Learner

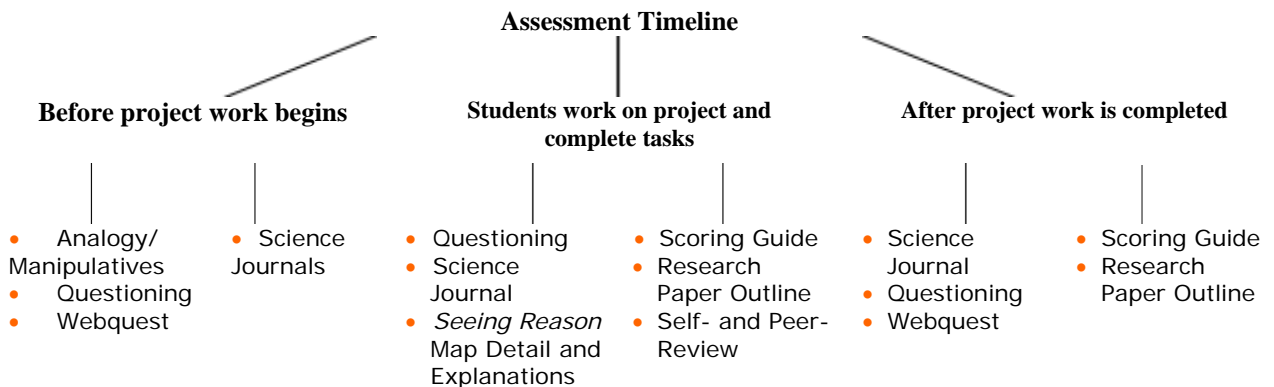
- Provide texts from language of origin.
- Encourage students to research their animals using native language sources.
- Enlist the help of students who speak the same language and have greater proficiency in English.

Credits

A science teacher who used the *Seeing Reason Tool* with her class developed the idea for this Unit Plan. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED (highlight box)

Assessment Plan



Have students use manipulatives (balancing nail activity) to help them understand the concept of interdependence. Through the questioning and discussion, assess and build upon their prior knowledge. Use the *Oh Deer!* activity and discussion to assess their understanding of limiting factors. Use the [Webquest](#) to help guide their learning, keep them on track, and find resources for their research. Assess the quality of their science journal entries and *Seeing Reason* maps (causal relationship explanations, sources, overall understanding of the ecological system) to monitor progress and understanding of content. Use questioning throughout the unit to help students develop their higher-order thinking skills and process content. Have students use the [scoring guide](#) to help them self- and peer-assess work prior to their report and presentation's completion. Use this same [scoring guide](#) and the details in the [Webquest](#) and [research paper outline](#) to assess and grade the final project.

Targeted Content Standards and Benchmarks

Benchmarks for Science Literacy—Benchmark 5, Level 6-8 and 9-12

- Two organisms may interact with one another in several ways: They may be in a producer/consumer, predator/prey, or parasite/host relationship. Or, one organism may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.

- Ecosystems can be reasonably stable over hundreds or thousands of years. As any population of organisms grows, it is held in check by one or more environmental factors: depletion of food or nesting sites, increased loss to increased numbers of predators, or parasites. If a disaster such as flood or fire occurs, the damaged ecosystem is likely to recover in stages that eventually result in a system similar to the original one.
- Like many complex systems, ecosystems tend to have cyclical fluctuations around a state of rough equilibrium. In the long run, however, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution.
- Human beings are part of the Earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.

Student Objectives

Students will:

- Understand the importance of balanced systems
- Distinguish between a food chain and a food web
- Identify some interactions or relationships between organisms in an ecosystem
- Explain limiting factors and their relationship to population density
- Describe how succession can be caused by human actions
- Identify current environmental issues and possible solutions

Materials and Resources

Printed Materials

- Reference books: field guides, natural history texts, encyclopedias
- *Project Wild: K-12 Curriculum & Activity Guide* (2002). Council for Environmental Education. Houston: TX.

Supplies

- 13 8-penny nails with flat heads (not finishing nails)
- 1 block of wood approximately 10 cm by 4 cm (or a big chunk of clay could substitute for the wood)

Internet Resources

The Ecology Explorers Webquest provides a list of Web sites for students in the Southwest. Use the list as an example for making your own set of student research links, and also direct students to these sites:

- United States Environmental Protection Agency Student Center
www.epa.gov/students*
Environmental concepts, activities, and tips for students in grades 5-8
- United States Fish and Wildlife Service Endangered Species Program
<http://endangered.fws.gov/>*
Information on plants and animals on the threatened and endangered species lists

The following are Internet resources for the teacher:

- Ecology: Interdependence of Life (PDF; 32 pages)
<http://www.rickhershberger.com/bioactivesite/ecology/ecology.pdf>*

Explanations of ecology concepts

- Teacher.net Gazette

<http://teachers.net/gazette/MAY02/stanimirovic2.html>

Offers description of *Oh Deer!* simulation

Other Resources

Develop a phone or email list for potential interview subjects, such as local ranchers, fishermen, logging or mining industry representatives, politicians, policy makers from state or federal agencies, local conservation groups, university scientists, state fish, game, and wildlife personnel.

Technology – Hardware

- Computers for Internet research and creation of word processing document and multimedia products to support the oral presentation
- Presentation equipment (projector and screen) for the oral presentations
- Digital camera (optional) to take pictures of local habitat and animals, interviewees, students' presentations
- Video camera (optional) for interviews and student multimedia support (video clips) for their multimedia support of their oral presentation

Technology – Software

- Word processor for written reports, handouts for presentations, and other multimedia supporting documents
- Multimedia presentation software for oral presentations
- Multimedia atlas (optional) for research and image resources
- Electronic encyclopedias (optional) for research and image resources