



Ecology Explorers

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 Question**
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

At a Glance

Grade Level: 6-8

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

Things You Need

[Assessment](#)

[Standards](#)

[Resources](#)

their audience as the (simulated) National Wildlife Conservation Board.

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 Using Seeing Reason

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.

Before proceeding with the next activity, click [here](#) to set up the Ecology Explorers:Overlapping Habitat project in your workspace. Have students use *Seeing Reason* to help them understand what happens when human and animal habitats overlap.

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:

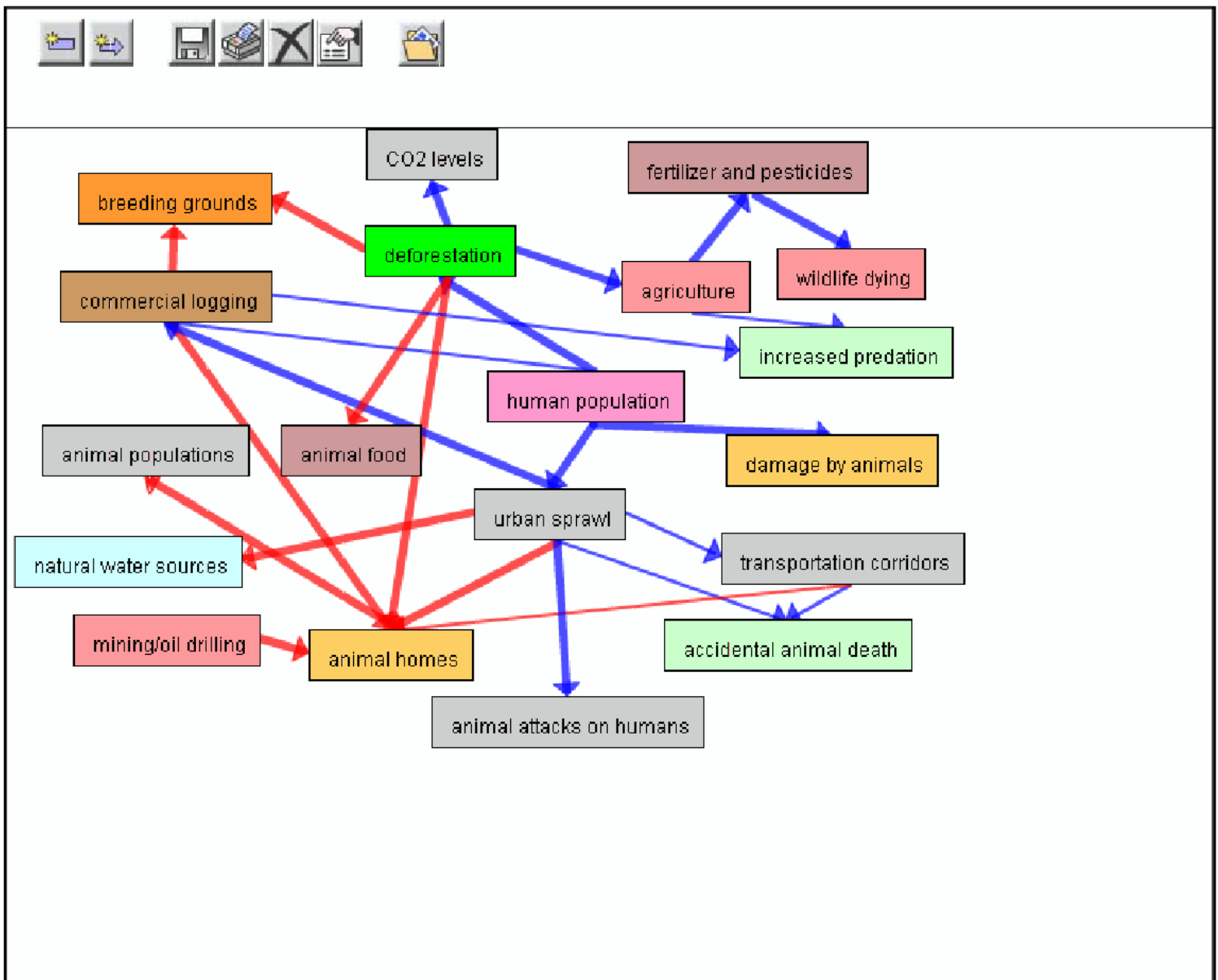
- *Why are animal homes so important? How do animals that live in the forest depend on trees?*
- *How can an animal's success be affected by its direct or indirect interactions with humans?*
- *What do you think might be the long-term effects of these encounters on animal behaviors and social structures?*

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 [\(Click here to set up this project in your workspace\)](#)

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.

Before proceeding with the next activity, click [here](#) to set up Ecology Explorers: Species Success project in your workspace. 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:

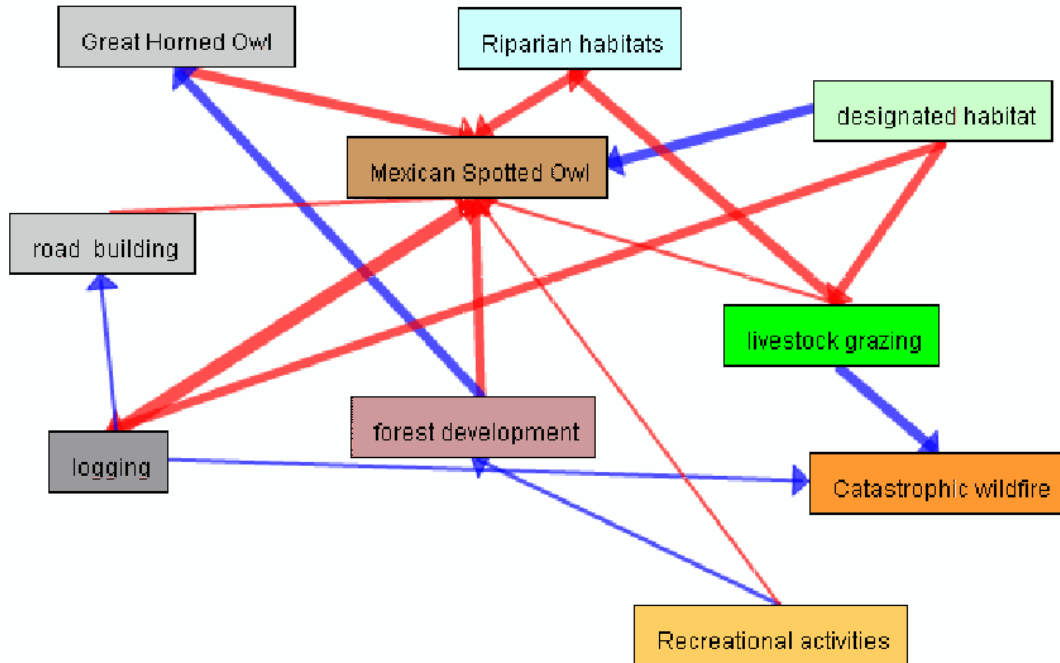
- *Can you compare the ways in which humans and animals have adapted to life in this habitat?*
- *In what ways might the presence of humans in this habitat affect animal behaviors?*

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 ([Click here to set up this project in your workspace](#))

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

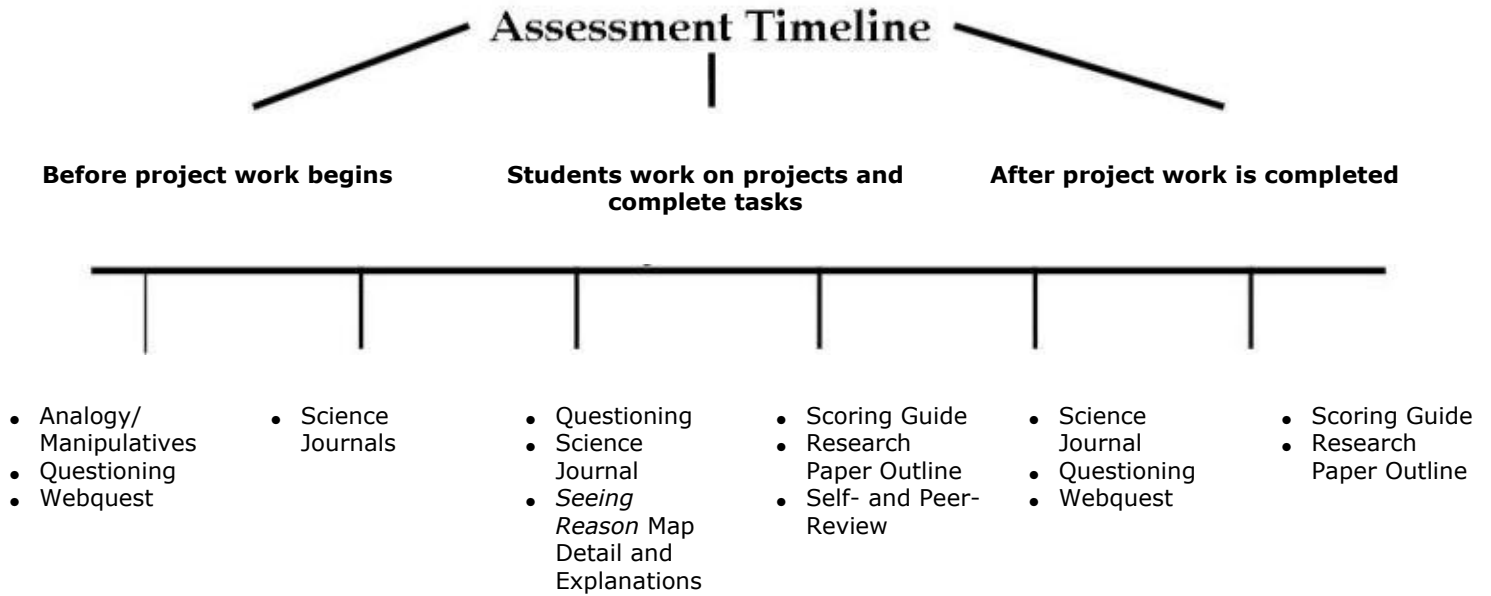
- Provide texts from language of origin.
- Encourage students to research their animals using native language sources.
- Enlist the help of students who speak the same language and have greater proficiency in English.

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.

Seeing Reason Tool: Ecology Explorers Assessment Plan

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.

Seeing Reason Tool: Ecology Explorers

Content Standards and Objectives

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

Seeing Reason Tool: Ecology Explorers Resources

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)
www.rickhershberger.com/bioactivesite/ecology/ecology.pdf*
Explanations of ecology concepts
- Teacher.netGazette
<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, animals, interviewees, and 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

Ecology Explorers

Introduction

In our growing world, wildlife and human habitats are bound to overlap. Human-wildlife interactions, which occur in both rural and urban areas, can upset the survival of a species, as well as have impact on the humans of the area. It is important for us to try to live in harmony with the environment around us.

Task

As a wildlife conservationist, you must be aware of the outcomes of human/wildlife interactions. You will be part of a panel of experts, each of whom will have studied a specific species that is currently endangered in your state. Your position requires you to know everything about your particular species, including the human interactions that occur, and how this human activity affects the organism's survival. You will prepare a presentation for the conservation board (or other assigned audience) that includes practical and economically feasible solutions to ensure the continued existence of all the species researched by your team.

1. With a fellow conservationist in your group, go to your team's [Seeing Reason](#) account and create a map to answer the following question under the project **Overlapping Habitats**: What happens when human and animal habitats overlap? Research the relationships between humans and animals using the Web sites below.

General Resources on Habitats
The rarest information around*
Habitat Loss*
Deforestation and Habitat Destruction*
Wildlife Protection*
General Environmental Resources
Environmental Protection Agency*

2. Within your group, decide who is going to be the expert for each species assigned to your group. Individually, conduct research on your particular species, using the Web sites provided as a starting point for your research. Below are the animals assigned to each group:
 - Group 1: Southwestern United States
 - Mexican Spotted Owl
 - Mexican Gray Wolf
 - Colorado Pikeminnow
 - Mount Graham Red Squirrel
 - Group 2: Central and Southern Africa
 - Mountain Gorilla
 - Mountain Zebra
 - Black Rhinoceros
 - Riverine Rabbit
 - Group 3: South America
 - Jaguar
 - Scarlet Macaw
 - Golden-Rumped Lion Tamarin
 - Brazilian Tapir
 - Group 4: Asia
 - Snow Leopard

- Black Necked Crane
 - Red Panda
 - Bengal Tiger
 - Group 5: Australia
 - Greater Bilby
 - Numbat
 - Northern Hairy-nosed Wombat
 - Western Swamp Tortoise
3. Use the questions below to assist you in conducting your research and planning your report. You are responsible for handing in an individual report detailing the questions and answers assigned for your species. You and the other members of your team will also be responsible for proposing a series of recommendations that includes practical and economically feasible solutions to ensure the continued existence of all your species.

Questions to be answered for each species:

- Introduction
 - Hook – What interesting fact, startling statement, or quote could you use to hook your reader?
 - What background information should your reader know? Consider your audience and what they would already know.
 - What are you going to talk about in this report and why? Be sure to mention the full name of your species.
- General information
 - What is your animal and where is it found in the world?
 - What is the ideal habitat for this species? Describe and illustrate.
- Your animal's place in the ecosystem
 - What is the ecological niche for your species? Describe how it fits into its ecosystem as a producer, consumer, decomposer, or combination of these.
 - How would the destruction of your species affect the ecosystem?
 - What would happen if we do nothing to stop the decline of this species?
- Impacts on your species
 - What influences the biological success of your species?
 - Directly and indirectly, how do humans negatively impact your species?
- Conservation and politics
 - What factors could alleviate or diminish the negative human influences on your species?
 - How do politics on both sides of the conservation issue play a role in the survival of your species?
 - What are some solutions that could help reduce the negative impacts, but still support human and business interests? Describe feasible solutions your region can adopt to ensure the continued survival of this species. Justify your answers.
- Concluding paragraph
 - How can people and animals coexist? Write a conclusion of what you learned and why it is important. End with a strong plan of action for your reader to consider.

4. Once your research is complete, team up with one of your conservationist partners to share your research on your selected species. (This can be, but doesn't have to be, the person you partnered up with earlier.) Choose either or both species to explore further by going to your team's [Seeing Reason](#) account and creating a map to answer the following question under **Ecology Explorers: Species Success**: What influences the biological success of your species? This should help you develop solutions to ensure continued existence of your species.
5. Use the Research Paper Outline to guide the creation of your formal report. Make sure the end of your report has practical and economically feasible solutions to ensure the continued existence of your species.
6. Once all the conservationists in your group have completed the first draft of the research report on their species, meet together and present your draft findings. Use the Report and Presentation Scoring Guide to peer assess your draft reports. This is the time that you can ask the other members of your group for advice on revising your writing.
7. The final product of this Webquest will have your group choose a presentation format that will provide an overview of your species, compare the needs/issues of all four species, explain the human/animal interactions that occur, and include practical and economically feasible solutions to ensure continued existence of the species. Your group will present your findings to the conservation board or other assigned audience.
 - Decide as a group which presentation format your group will use: Web page, multimedia presentation, poster, video, or even a play. If you have another idea for your group's presentation, obtain prior approval from the teacher.
 - Assign roles for the creation and presentation of the report. Ensure that the work is divided among the members fairly.
 - Include in your presentation:
 - A brief overview of each of the species
 - Native habitat/location of the species
 - A comparison of the needs/issues of all the species
 - Reasons for your species' decline in population
 - Recommendations for economically feasible/practical plan that would help all four species survive
 - A bibliography of your research sources

Guidance

- Review the Report and Presentation Scoring Guide before, during, and after researching and writing your report and preparing your presentation.
- Make sure you spend an adequate amount of time at each Web site. There is a lot of valuable information in each of the sites provided.
- **Read, read, read.** You won't get adequate answers if you only go to one research source. Make sure you read the information on the Web page or book. Look at the subtitles/links to help guide you to the sections you are looking for.
- Take notes as you do your research. Bookmark any Web sites that you find useful so that you can refer to them again quickly if necessary.
- Keep in mind the rules defining plagiarism. Plagiarism occurs when you steal or use the ideas or writings of another and present these writings or ideas as your own. You are not allowed to borrow passages from books, articles, or Web sites without identifying them.

Ecology Explorers: Report and Presentation Scoring Guide

	4	3	2	1	Points/ Comments
Introduction	A thorough introduction shows that the writer is very aware of the intended reader/ audience. Provides compelling reasons for the audience to read/ listen to the content that will follow. Includes hook, background, and thesis.	A clear introduction with hook, background, and thesis. Somewhat tailored to the intended audience.	A general overview of the content that will follow, but not tailored to the intended audience. Contains missing or incomplete elements of an introduction.	No information given as to what to expect in report/presentation	
Research (body of report) Points: x 5	Addresses all questions in the Webquest and research paper outline. Presents many supporting details. Responses show superior understanding of the material. Clearly writes for the intended audience.	Addresses all questions in the Webquest and research paper outline. Shows significant understanding of the material. Some evidence that the report is written for a specific audience.	Addresses most questions in the Webquest and research paper outline. Shows satisfactory understanding of the material. Little evidence that the report is written for a specific audience.	Addresses few questions in the Webquest. Shows limited understanding of the material. Disregard for the intended audience.	
Conclusion	Conclusion offers many recommendations for protecting a species. Recommendations based on reasoned analysis and justified by research. Takes into consideration whether solutions are practical and economically feasible. Insightful and imaginative solutions.	Conclusion offers several recommendations for protecting a species. Recommendations based on reasoned analysis and justified by research. Some solutions do not include evidence that they are practical or economically feasible.	Conclusion offers few recommendations for protecting a species. Recommendations not clearly based on reasoned analysis or justified by research. No discussion as to whether solutions are practical or economically feasible.	Does not offer concluding recommendations for protecting a species. No discussion as to whether solutions are practical or economically feasible.	
Sentence Fluency, Organization, and Conventions	Superior writing. Ideas are well stated. Work shows high level of organization. No notable grammar and spelling errors. Includes a complete bibliography with more than three sources.	Ideas are stated clearly. Work is organized. Few grammar and spelling errors, which detract from the work somewhat. Includes a complete bibliography.	Some ideas stated clearly. Organization is weak. Frequent grammar and spelling errors detract from the work. Bibliography is incomplete or missing.	Ideas not stated clearly. Work lacks organization or is incomplete. Grammar and spelling errors make report difficult to read. Bibliography is missing.	
Presentation Points: x 5	Presentation is very effective. Work surpasses standard. Smooth delivery. Comparisons of all assigned species reflect insightful understanding of their issues. Multimedia choices greatly enhance the message.	Presentation is clear and presented in an effective manner. Comparisons of all assigned species reflect a good understanding of their issues. Multimedia choices support the message.	Some elements of the presentation were confusing or ineffective. Delivery needs more practice. Comparisons of all assigned species reflect a basic understanding of their issues. Some multimedia choices do not clearly support the message.	Presentation is not effective. Practice not evident. Comparisons of all assigned species are incomplete or do not reflect an understanding of their issues. Multimedia elements are completely lacking or distort/distract from message.	
Total Points					

Ecology Explorers: Research Paper Format

Cover Page

Title, name, class, date, appropriate picture or illustration

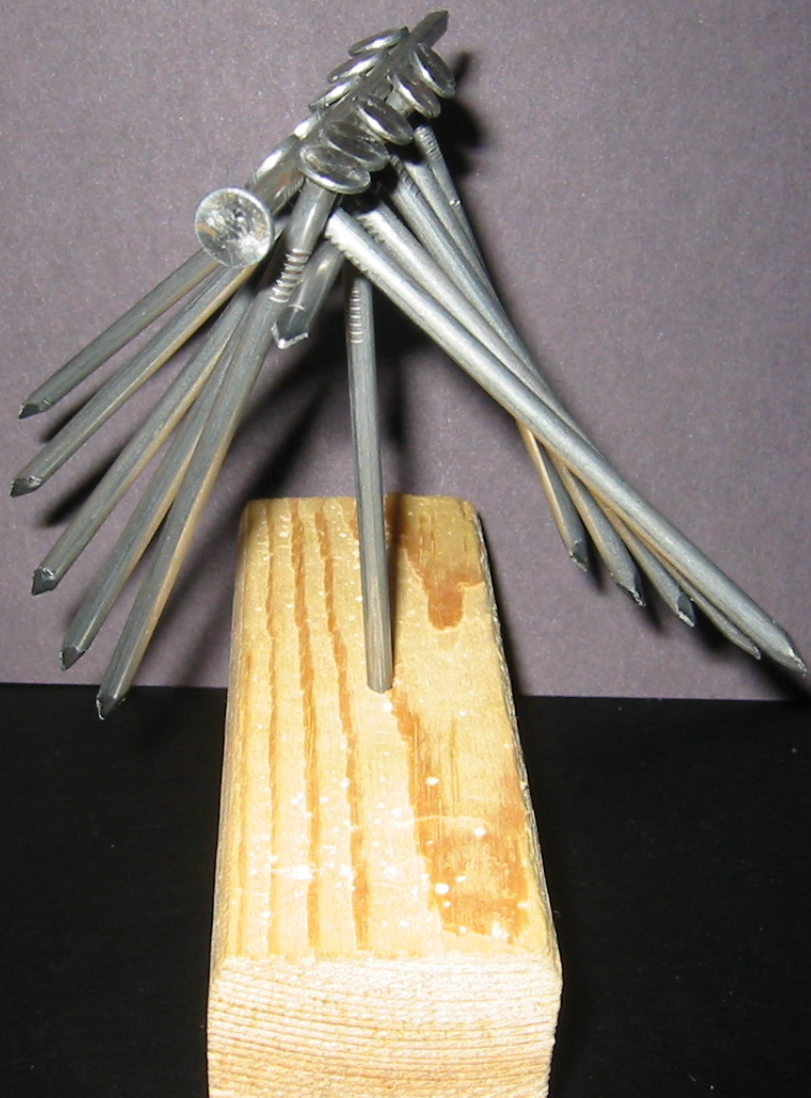
Report Contents

This is a detailed explanation of your endangered species and the problems it faces. Support ideas with references for different authorities and sources. Include illustrations, diagrams, and tables in body of paper. Answers all the questions posed in the Webquest:

- Introduction
 - Hook – What interesting fact, startling statement, or quote could you use to hook your reader?
 - What background information should your reader know? Consider your audience and what they would already know.
 - What are you going to talk about in this report and why? Be sure to mention the full name of your species.
- General information
 - What is your animal and where is it found in the world?
 - What is the ideal habitat for this species? Describe and illustrate.
- Your animal's place in the ecosystem
 - What is the ecological niche for your species? Describe how it fits into its ecosystem as a producer, consumer, decomposer, or combination of these.
 - How would the destruction of your species affect the ecosystem?
 - What would happen if we do nothing to stop the decline of this species?
- Impacts on your species
 - What influences the biological success of your species?
 - Directly and indirectly, how do humans negatively impact your species?
- Conservation and politics
 - What factors could alleviate or diminish the negative human influences on your species?
 - How do politics on both sides of the conservation issue play a role in the survival of your species?
 - What are some solutions that could help reduce the negative impacts, but still support human and business interests? Describe feasible solutions your region can adopt to ensure the continued survival of this species. Justify your answers.
- Concluding paragraph
 - How can people and animals coexist? Write a conclusion of what you learned and why it is important. End with a strong plan of action for your reader to consider.

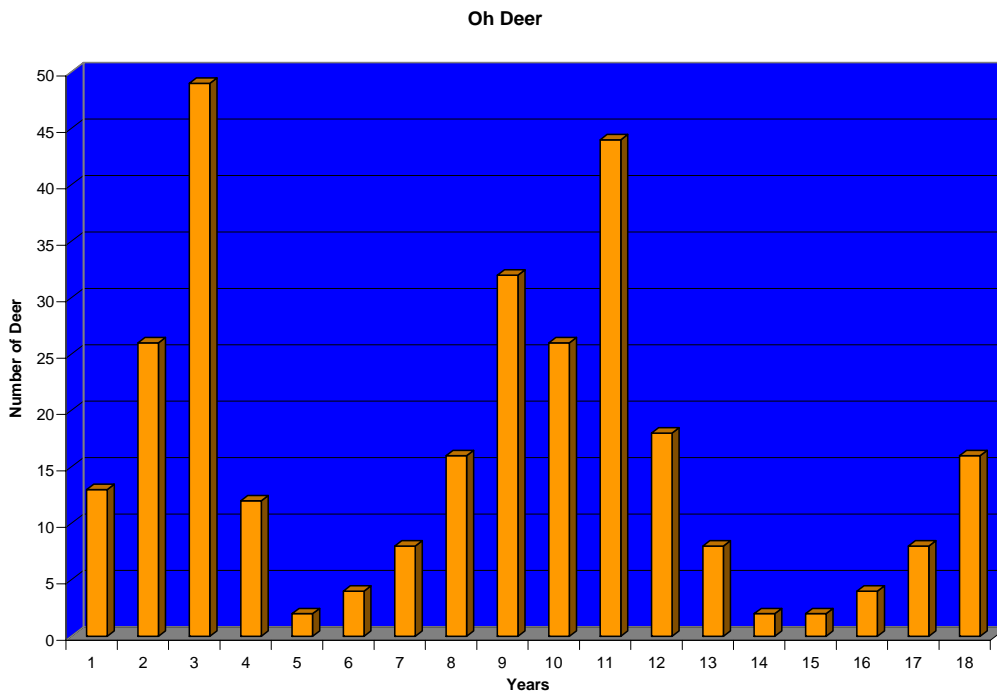
Bibliography

Include at least three references with complete bibliographic information in American Psychological Association (APA) format.



Oh Deer! Simulation

Team Graph and Explanation of Limiting Factors



Simulation results

Year	Deer	Explanation of Limiting Factors
1	13	
2	26	Deer population increased. They got food, water, and shelter needed to thrive and reproduce
3	49	Deer thrived again this year as they got what they needed to reproduce
4	12	Not enough essentials to support the deer population--not enough food, water, or shelter
5	2	The population went way down possibly due to disease, fire, bad weather, or another factor
6	4	The population of deer slowly increasing as remaining deer got what they need to survive
7	8	The population of deer slowly increasing as remaining deer got what they need to survive
8	16	Everything the deer need they are getting, so they are reproducing
9	32	Everything the deer need they are getting, so they are reproducing
10	26	Slight drop in population; deer did not get all of what they needed--drought conditions this year
11	44	Everything the deer need they are getting, so they are reproducing
12	18	Deer population decreased because a predator (wolf) was introduced to the area
13	8	Deer population continued to decrease because predator (wolf) was introduced to the area
14	2	Deer population continued to decrease because predator (wolf) was introduced to the area
15	2	Deer population still down but not wiped out; wolf population decreased due to fewer deer (prey)
16	4	Deer population slowly increasing as remaining deer got what they needed to survive
17	8	Deer population slowly increasing as remaining deer got what they needed to survive

Seeing Reason Tool: Ecology Explorers Webquest Research Sites

Ecology Explorers Webquest Initial Research Sites

- **Group 1: Southwestern United States**
- **Group 2: Central and Southern Africa**
- **Group 3: South America**
- **Group 4: Asia**
- **Group 5: Australia Group**

Group1: Southwestern United States

<p>Mexican Spotted Owl US Fish and Wildlife* Center for Biological Diversity* Texas Parks and Wildlife: Mexican Spotted Owl – Endangered 1993* Texas Parks and Wildlife: Mexican Spotted Owl - Species* Mexican Spotted Owl* Mexican Spotted Owl 2*</p>	<p>Mexican Gray Wolf U.S. Fish and Wildlife Service, The Mexican Wolf Recovery Program* Wolf Population Updates from Around the World* Sedgwick County Zoo* Mexican Gray Wolf* Grey Wolf* Mexican Wolf* Mexican Gray Wolf: Reintroduction* Mexican Gray Wolf – Center for Biological Diversity*</p>
<p>The Colorado Pikeminnow Endangered Colorado Basin Fish* Recovery Program* (PDF; 5 pages) Colorado Division of Wildlife* Colorado White Salmon* Upper Colorado River Endangered Fish Recovery Program*</p>	<p>Mount Graham Red Squirrel The Mount Graham Red Squirrel* Mount Graham* Mount Graham Red Squirrel Survey* Environmental Issues* Mount Graham Red Squirrel* Mount Graham Coalition* Mount Graham red squirrel fall 2005 count announced*</p>

Group 2: Central and Southern Africa

<p>Mountain Gorilla Mountain Gorilla* Exploring the Environment: Mountain Gorillas* Mountain Gorilla* Creature Feature: Mountain Gorilla* Mountain Gorilla*</p>	<p>Black Rhinoceros Black Rhino* Black Rhinoceros* Rhinos > Black Rhinos* Rhinoceros* TED Case Studies: RHINO* Black Rhino*</p>
<p>Mountain Zebra (<i>Equus zebra</i>) Equus zebra* Mountain Zebra* A Guide to the: Cape Mountain Zebra* Equus Zebra*</p>	<p>Riverine Rabbit Animal Info - Riverine Rabbit* Riverine Rabbit Conservation Project* Riverine Rabbit* Odds stacking up against survival of riverine rabbits*</p>

Group 3: South America

<p>Jaguar Jaguar* Big Cat Rescue: Jaguar* All About Jaguars* Mammals: Jaguar*</p>	<p>Scarlet Macaw Ara macao (scarlet macaw)* Scarlet Macaw* Scarlet Macaw* Scarlet Macaw*</p>
<p>Golden-rumped Lion Tamarin also known as Black Lion Tamarin Animal Info - Golden-rumped Lion Tamarin* Golden-rumped Lion Tamarin* A Profile of the Lion Tamarin* The Lion Tamarins of Lower Brazil* Saving the Atlantic Forest*</p>	<p>Brazilian Tapir Brazilian Tapir* Brazilian Tapir* The Tapir Gallery: Focus on the lowland tapir* Tapirus terrestris (Brazilian Tapir)*</p>

Group 4: Asia

<p>Snow Leopard Endangered Animals: Snow Leopard* Fact Sheet: Snow Leopard* Snow Leopard* Animal Info – Snow Leopard*</p>	<p>Black Necked Crane The Cranes* Black-Necked Crane* Black necked Crane* Black-necked crane*</p>
<p>Red Panda Mammal Fact Sheet: Red Panda* Animal Info - Red Panda* Red Panda* Red Panda*</p>	<p>Bengal Tiger Asia: Bengal Tiger* Wild Tigers: Bengal Tigers* All About Bengal Tigers* The Royal Bengal Tiger* Indian Tiger: Bengal Tiger*</p>

Group 5: Australia

<p>Greater Bilby Greater Bilby* The Bilby* Greater Bilby* Reintroducing the Bilby to South Australia*</p>	<p>Northern Hairy-nosed Wombat Northern Hairy-nosed Wombat* Northern Hairy Nosed Wombat* Wombat Info Center: Northern Hairy Nosed Wombat* Animal Info - Northern Hairy-nosed Wombat*</p>
<p>Numbat Numbat* Numbat* Australian Numbat* Plants & Animals: Numbat*</p>	<p>Western Swamp Tortoise Western Swamp Tortoise* Western Swamp Tortoise* Western Swamp Tortoise* Western Swamp Tortoise*</p>



Ecology Explorers: Endangered Species of the Southwestern United States



By Luis, Jessica, Kamal, and Alison



Four Endangered Species of the Southwestern United States

Mexican Spotted Owl -



© Photo courtesy F.R. Gehlbach
Note: Special thanks to the photographers for providing images of Texas endangered and threatened animals. All rights to these images are reserved. Educational use permitted.



Credit: U.S. Fish and Wildlife Service

- Mexican Gray Wolf

Colorado Pikeminnow -



Credit: U.S. Fish and Wildlife Service.
Photo by James E. Johnson/U.S. Fish and Wildlife Service



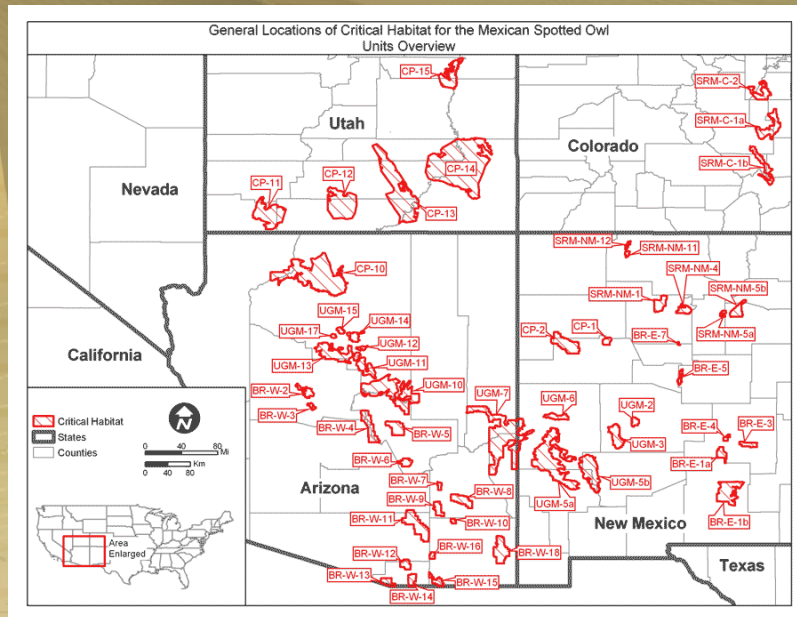
Credit: U.S. Fish and Wildlife Service,
Arizona Ecological Services Field Office

- Mount Graham Red Squirrel

The Mexican Spotted Owl



Credit: U.S. Fish and Wildlife Service, Southwestern Region



Designated areas of critical habitat for the Mexican Spotted Owl
Credit: U.S. Fish and Wildlife Service

- Ashy-chestnut colored animal with white and brown spots
- Lives in forests of old white pine, Douglas fir, and ponderosa pine trees
- Prefers being in an area of steep slopes, rocky cliffs and canyons
- Eats insects, small birds, and other small animals
- An estimated 2,106 are alive in the U.S. (1990)
- Put on the Endangered Species list in 1993

The Mexican Gray Wolf



Credit: U.S. Fish and Wildlife Service



Historic range of the Mexican Gray Wolf

Credit: U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program (Map found on [Fieldtrip Earth](#) Web site)

Recovery area of the Mexican Gray Wolf
Credit: U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program (Map found on [Fieldtrip Earth](#) Web site, North Carolina Zoological Society)

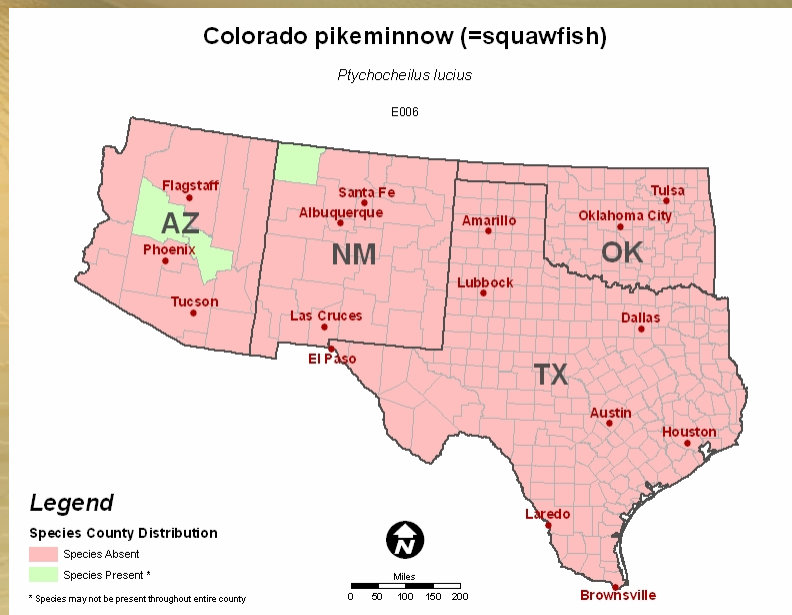
- Also known as “El Lobo”
- Measures about 5 1/2 feet in length (about the size of a German shepherd)
- Subspecies of the Gray Wolf
- Lives in the mountainous regions from central Mexico through southeastern Arizona, southern New Mexico, and southwestern Texas
- Captive-reared Mexican Wolves have been released in the Apache National Forest in eastern Arizona to be reintroduced.
- An estimated 49 wolves are in the wild (2004)
- Put on the Endangered Species list in 1976

Colorado Pikeminnow



Credit: U. S. Fish and Wildlife Service, San Juan River Basin Recovery Implementation Program

- Called "white salmon" and "Colorado salmon" by early settlers; also known as "Colorado squawfish"
- Torpedo-shaped fish with an olive-green and gold back, silver sides and white belly
- The largest minnow in North America and one of the largest in the world
- Before it was endangered, it may have lived 50 or more years, growing to nearly 6 feet long and weighing up to 80 pounds
- Today, it normally grows 18 to 22 inches long, weighing 2 to 4 pounds
- Historically lived in the Colorado River and its major tributaries in Colorado, Wyoming, Utah, New Mexico, Arizona, Nevada, California and Mexico
- Now can only be found in parts of Arizona and New Mexico.
- Estimated 700 adult fish in the Colorado River; 2,300 in the Green River system (2005)
- Put on the Endangered Species list in 1967

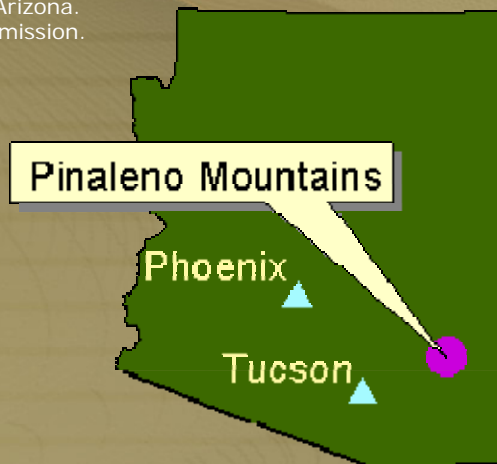


Green areas show the current locations of the Colorado Pikeminnow
Credit: U. S. Fish and Wildlife Service

Mount Graham Red Squirrel



Credit: School of Natural Resources - Mt. Graham Biology Programs
© 2006 Regents, University of Arizona.
Used with permission.



Only known location of Mount Graham Red Squirrels
Credit: School of Natural Resources - Mt. Graham Biology Programs
© 2006 Regents, University of Arizona
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- Grayish-brown tree squirrel, tinged rusty or yellowish along the back
- Lives only on the Pinaleno (Graham) Mountains of southeastern Arizona from elevations of about 7800 feet on the north and east slopes to 10,720 feet
- An estimated 276 Mount Graham Red Squirrels are alive in the wild (2005)
- Put on the Endangered Species list in 1987

How does the ecosystem benefit from these animals?

- **Mexican Spotted Owl**

- Balance in the number of animals that they prey on such as mice, wood rats, pocket gophers, birds, insects, rabbits and reptiles

- **Mexican Gray Wolf**

- Manage elk, deer, coyote, and other prey populations
- Removal of some of the coyotes by the wolves has given other medium predators (such as the red fox) a chance to survive
- Scavenger animals benefit from their kills

- **Colorado Pikeminnow**

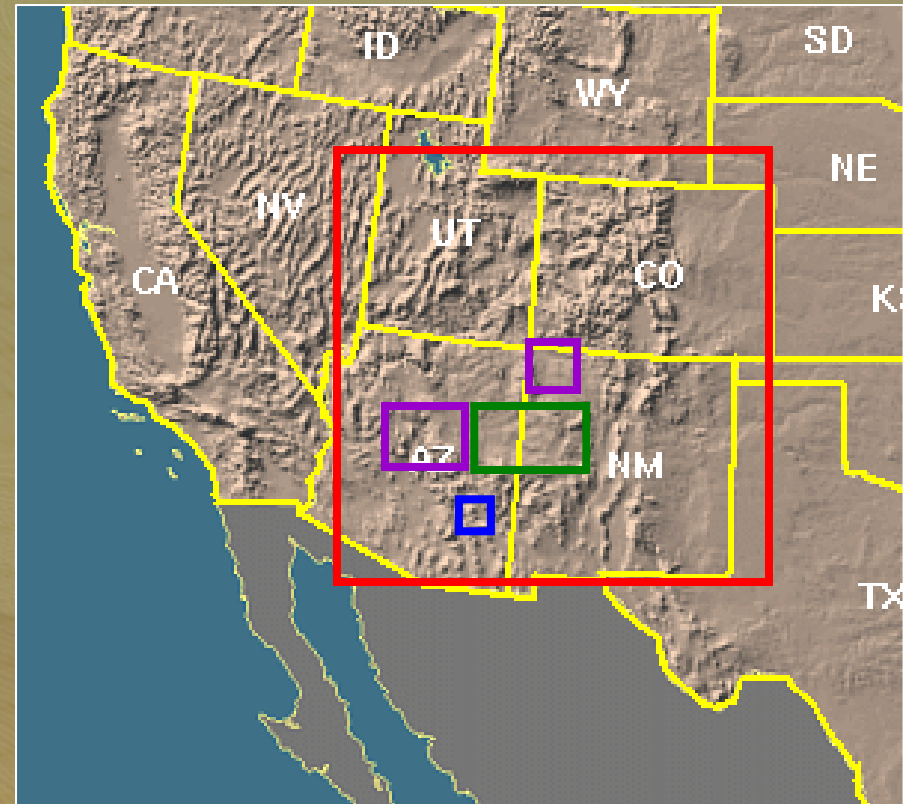
- Balance of other fish populations

- **Mount Graham Red Squirrels**

- Their foraging helps the planting and sprouting of seeds throughout the forest.
- They may also scatter fungi throughout the forest.

Common Issue: Human Development

- Logging, recreational activities, cattle grazing, development, fires reduce the **Mexican Spotted Owl's** habitat
- The **Mexican Gray Wolves** are killed off to save livestock; habitat has been developed
- Dams reduce water flow, block migration, and lower water temperature for the **Colorado Pikeminnows**; over 40 non-native fish have been introduced--which end up being competitors or predators of the pikeminnow
- **Mount Graham Red Squirrels'** habitat has been shrinking because of logging, fire, development, and loss of food resources (because of beetle infestation of trees)



Base map courtesy of CDC United States Climate Page

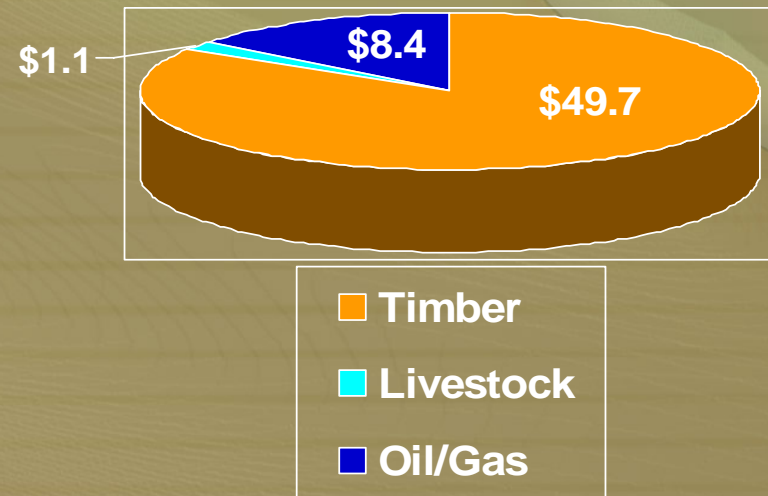
- Mexican Spotted Owl
- Mexican Gray Wolf
- Colorado Pikeminnow
- Mount Graham Red Squirrel



Mexican Spotted Owl: Protection at a Cost

- Currently protected habitat: **8.6 million acres** in Arizona, Colorado, New Mexico, and Utah
- Financial impacts to the timber industry, Native American tribes, livestock grazing, fire management, small businesses, oil and gas development, and mining activities.

Estimated Losses in Revenue to Businesses Annually: \$59.2 million



- Possible regional economic impacts: **\$59.2 million** and loss of **495 jobs** in timber, livestock, and oil/gas companies
- Total past costs associated with federal land management of rangelands are estimated at **\$6 million to \$20.6 million** since the listing of the Mexican Spotted Owl
- Future estimated costs range from **\$9.5 to \$32.9 million** over the next 10 years (or \$1.0 to \$3.3 million per year) ([2004 economic analysis report](#))

Mexican Gray Wolf: Protection at a Cost

- Currently protected habitat: **5,000 square miles** in Arizona and New Mexico
- Financial impacts to ranchers and costs to the government
- Positive impacts to tourism
- Between 1998 and 2004, ranchers have been reimbursed by the government for livestock losses totaling **\$33,640**
- The estimated loss in 2004 to ranchers that were not reimbursed: somewhere between **\$4,375 and \$126,011** ([Paper presented at the International Wolf Conference, October 2005](#))
- Estimated costs of Mexican wolf conservation by cooperating agencies since initial releases occurred in 1998: **\$7.3 million** [[Five-Year Report](#) by the Mexican Wolf Adaptive Management Oversight Committee]

Colorado Pikeminnow: Protection at a Cost

- Total Agency Contributions for the Upper Colorado River Endangered Fish Recovery Program (1989-2005):

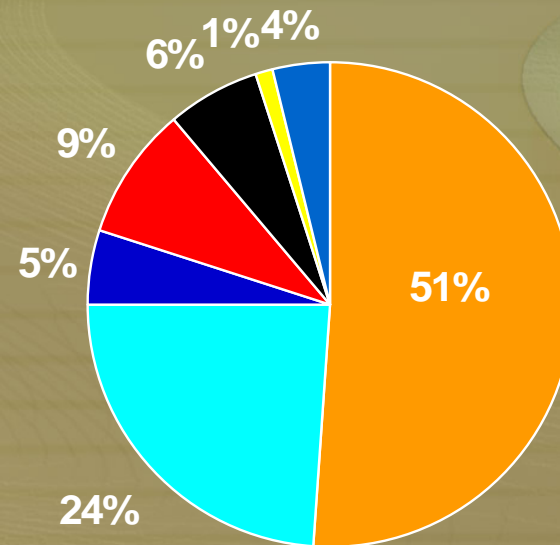
\$150 million

- Total Agency Contributions for the San Juan River Basin Recovery Implementation Program (1989-2005):

\$26.7 million

(Both programs are for all endangered fish on these rivers, not just the Colorado Pikeminnow)

[\(2004-2005 Program Highlights\)](#)



Mount Graham Red Squirrel: Protection at a Cost

- **6.8 acres** of protected Mount Graham Red Squirrel habitat in Arizona is currently at odds with a **\$200 million** Mount Graham International Observatory, which eventually could feature the world's largest optical telescope
- 2 of the 8 telescopes have been built
- The telescope project, if completed, would generate **tens of millions** of dollars of federal research grants each year that could support programs throughout the University of Arizona
- Six biologists are watching red squirrels in a monitoring project that costs the university upwards of **\$200,000** a year.

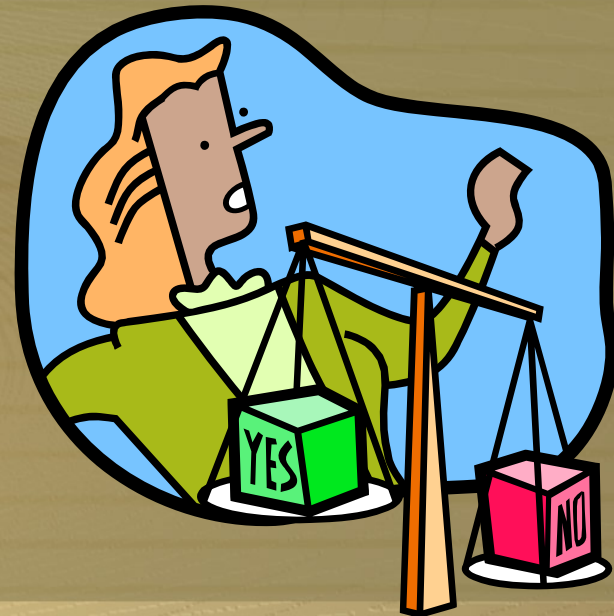


Mount Graham International Observatory

Credit for the pictures above: School of Natural Resources
- Mt. Graham Biology Programs
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Solutions We *Don't* Think are Worth the Cost

- Removal of dams on the Colorado River
- Increasing the acreage of protected land
- Stopping the construction of telescopes on Mount Graham
- Completely cutting off use of public lands
 - Clear-cutting: no
 - Managed use: yes



Our Solutions



- Maintain the current 13.5 million acres of protected habitat under the Forest Practices Act and uphold the Endangered Species Act.
- Continue to re-stock endangered fish and provide means for fish to migrate past dams
- Impose high fines for illegal hunting.
- Reduce livestock grazing in sensitive areas.
- Manage areas to reduce chance of catastrophic fires.
- Educate people on endangered animals and how they can help protect them.
- Monitor population numbers to know if solutions are working--if they're not, then it's not worth the continued cost.

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