Eco Investigator
Grades 4 - 8

As of August 2000 there are 101 endangered and threatened species in Tennessee. Each of these species has very specific habitat requirements found within a specific ecosystem. These ecosystems are declining due to many threats, including development, pollution, and nonnative species. In this activity, students are introduced to a variety of endangered and threatened species in Tennessee and the ecosystems they depend on. Students learn about the species, their role in the ecosystem, threats to the ecosystem, and what they can do to help.

Age
Grades 4 - 8

Time
Two class periods of 50 minutes each.

Setting
The classroom or any work area where students can divide up and work in pairs.

Correlation:
4th grade
C: Life Science
D: Earth Science
E: Science and Technology
F: Science in Personal and Social Perspectives

5th - 8th grade
C: Life Sciences

Objective
Students will be able to (1) list and describe some of Tennessee's endangered and threatened species and their ecosystems and (2) describe the difference between habitat and an ecosystem.

Materials

- One Copy of each Ecosystem Fact Sheet and Species Description (pages 24-79)
- Coloring materials—crayons, paints, or markers
- Poster board or butcher paper
- Scissors, and string (thread or yarn)
- Paper hole punch
- Props for interviewing (hats, microphone, costumes, etc.)
- Copies of the Student Comparison Chart, page 105 (Optional)

Preparation

- Review all seven Ecosystem Fact Sheets (pages 24-79), both the Teacher and Student Ecosystem Comparison Charts (page 105 and 106), and the Ecosystem versus Habitat fact sheet on page 103 in this activity.
- Choose one ecosystem to review with the class and the species fact sheets associated with that ecosystem. Refer to the Ecosystem Comparison Chart on page 105 and 106 for help listing the living and nonliving parts during the class discussion. You may also want to use a marker to highlight the species' habitat needs and their role in the ecosystem on each Species Description so you can refer to that information easily during the discussion with the class.
- Write these questions on the board for the students to use for their interviews: Where do you live? What do you eat? Why are you endangered or threatened ? What ecosystem do you live in? What is your role in the ecosystem? What are the threats to that ecosystem? Students can also be creative and ask other questions.

Procedure

1. Divide the class into six groups. Assign each team or group one of the remaining six ecosystems. Pass out the Ecosystem Fact Sheet and the Species Descriptions that go with the ecosystem. See below regarding the Student Ecosystem Comparison Chart.

Depending on the level of your students you may want to give them the Student Ecosystem Comparison Chart. The intermediate and advanced level students would benefit more from reading the Ecosystem Fact Sheets. Please read through the Ecosystem Fact Sheets and the Student Ecosystem Comparison Chart to determine which option is best for them or if both references would be useful. The benefit of the Ecosystem Fact Sheets are the pictures that they can use to help visualize the ecosystem and create props for this activity.

2. Explain to the students that they will be learning about some of Tennessee's most imperiled ecosystems and the endangered and threatened species that depend on them. Discuss with the students how an ecosystem is different from habitat (page 103). Refer to the ecosystem you chose in preparing this activity, pointing out some of the living and nonliving parts. Then use the endangered and threatened species descriptions associated with that system to discuss the species' habitat needs and their role in the ecosystem. Discuss with students our role in that ecosystem; e.g. we get drinking water from the spring ecosystem. Discuss the threats to that system, such as pollutants in the spring ecosystem. Discussion questions might include: Are we part of the ecosystem? How do we use and benefit from the living parts (plants and animals) of the ecosystem? How do we use and benefit from the nonliving parts (air, soil, water) of the ecosystem? For older students: Can we harm the

ecosystem parts? In what ways? Can we fix the ecosystem parts? In what ways?

3 a. Explain that in their assigned groups they are to each choose one of the Species Descriptions. One person will play the part of the species, the other person will be a reporter, and so on, until all the species have been interviewed. Have the students refer to interview questions you wrote on the board for guidance. Encourage each group to create costumes and props and act the parts of the species and reporters for the class. **Note**: You may have to make some adjustments on the time for interviews and/or how many interviews are done per group because some ecosystems have more species to interview than other ecosystems.

b. Referring to the Ecosystem Fact Sheet and/or the Student Ecosystem Comparison Chart for appropriate information, have one student in each group be interviewed as the ecosystem. Also encourage students to create the ecosystem as a background for the species interviews using props and poster board or butcher paper.

c. Each species interview should take about 10 minutes. Each group should prepare interviews for the class. Give students up to 20 minutes to prepare their interviews.

Evaluation:
1. Revisit the discussion questions from #2 and #3 in the procedure. Encourage students to answer the questions using their new knowledge of the ecosystem they learned about.
2. Assemble ecosystem mobiles. See the information and cutouts that are on the following pages in this activity.

Extension:
1. Ask a local reporter to attend the class and listen to the interviews.

2. Send the interviews to the local paper.

3.a.Visit an ecosystem near the school. Contact a local natural resources specialist to join the class. For example, your class could visit a local river. The natural resources specialist could potentially help lead a class exploration of what species live in the river, how good the vegetated buffer along the stream is, what threats are occurring along the stream, and what action is needed to improve or maintain the stream.

b. Students can take what they learned from their exploration and write a letter to the local newspaper; prepare a school bulletin board to teach other students about the ecosystem; or come up with an action plan to improve a threat to the ecosystem, such as organizing a stream cleanup and setting up a water monitoring station. (For more information on these ideas, talk to your local Soil and Water Conservation District Office.)

Ecosystem Mobile

Preparation:
Check out the sample mobiles on pages 87 and 88 and decide which mobile you want your students to make. If you choose a mobile on page 88 you may choose to increase the number of circles you provide each team.

Depending on the age level of your class, you may wish to cut out the ecosystem mobile parts and the pieces of string (1 to 1-1/2 feet long; can be trimmed later if necessary).

Make copies of the Student Ecosystem Comparison Chart and cutouts (pages 89 to 105).

Procedure:
1. Give each team copies of the ecosystem and species cutouts they just studied. Have the students color their ecosystem and the endangered and threatened species illustrated in the circle-shaped cutouts. Have them fill in blank circles with other species and nonliving parts that occur in that ecosystem. For ideas they can refer to the ecosystem fact sheets and the Student Ecosystem Comparison Chart.

Each mobile should consist of the large ecosystem illustration, and six circles that includes the endangered and threatened species of that ecosystem and other living and nonliving parts. Examples of other living parts could be people and other common animals like a racoon, hawk, turtle, etc. Other examples of nonliving parts could include the sun, soil, rain, minerals, etc. Students should cut out the circles when they have finished coloring.

2. Using a paper hole punch, have the students punch six small holes at the bottom of their ecosystem cutout. Punch a hole at the top of each smaller circle. If preferred, for younger students, have the students paste their cutouts on poster board. Using the string or yarn, connect each species or part with its ecosystem. The species, or parts (circles), should hang freely.

3. Punch two more holes in the top of the ecosystem cutout and hang the mobiles up for display.

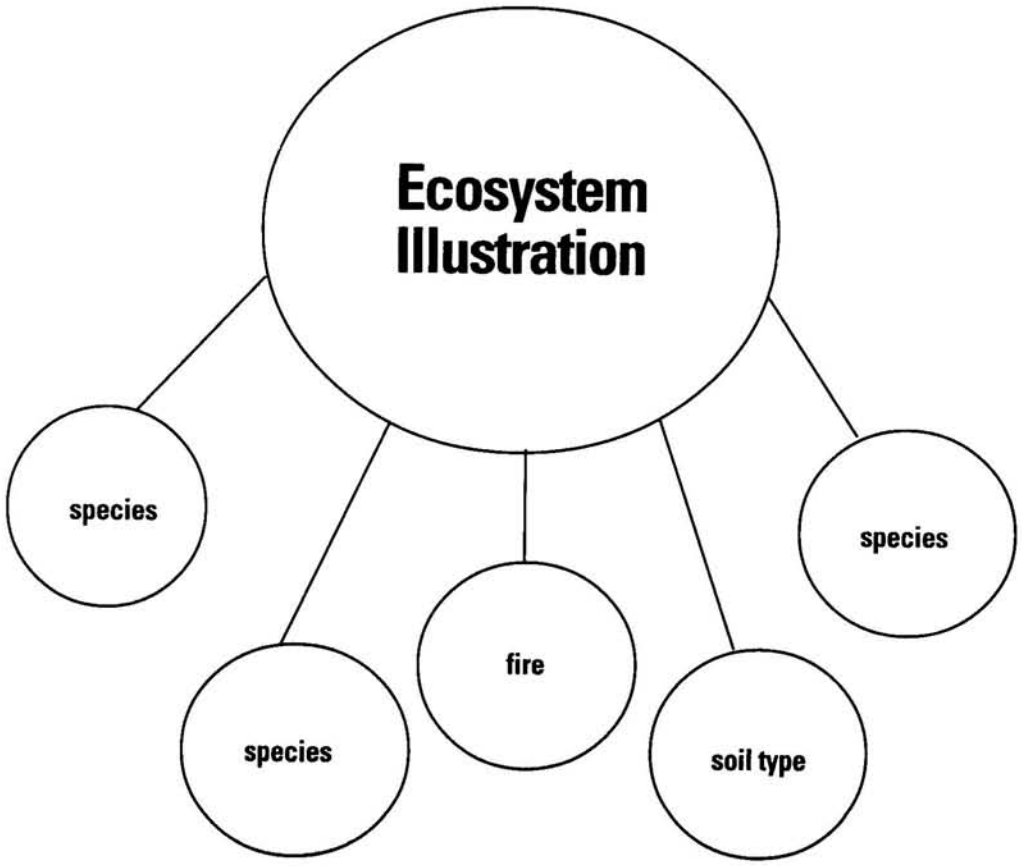
Sample Mobile

Extensions and Variations

1. After the students have completed the Web of Life activity, they can add more living and nonliving parts to their mobile.

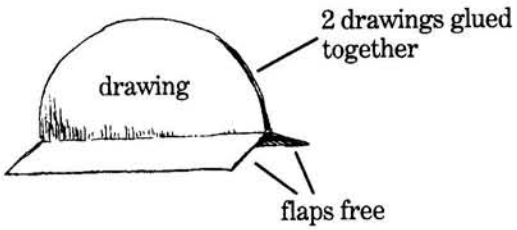
2. Depending on the level of your students, you may wish to have them write on the back of each circle what role that part or species plays in its ecosystem. The roles of endangered and threatened species are in the species descriptions in this guide. Students will have to use their knowledge of what they already know about earth science and basic biology to deduce what roles nonliving parts play in the ecosystem. For instance, the soil provides important nutrients to plants. Also, since information is not specifically provided on the roles other living parts play in their ecosystem (in addition to the endangered and threatened species in this guide), students will have to use their knowledge to figure out those roles. For example, frogs eat insects and are food for other birds and fish; alder trees stabilize the stream bank and provide cover for young fish, snails, and crayfish.

3. Make a set of each cutout sheet at a reduced size. Then cut out each ecosystem and species. Have groups of students play "ecosystem match-up," in which they match the species with its corresponding ecosystem.



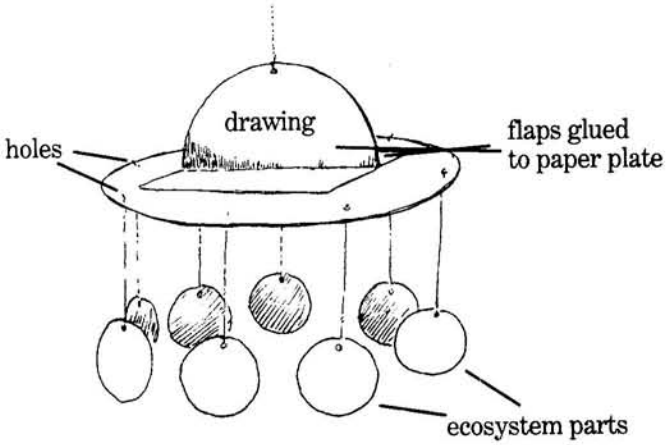
Ideas for assembling the mobile

1. Glue 2 copies of the ecosystem drawing back to back, leaving flaps free.



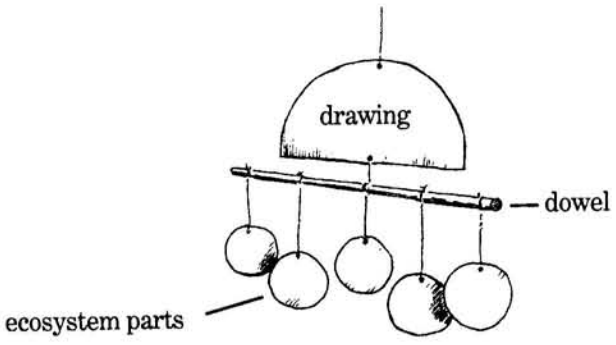
2. Glue flaps flat to a paper plate as shown.

3. Punch holes (number equal to the number of circles) evenly around the edge of paper plate and attach circles with string.



Another idea:

Use stick or dowel instead of paper plate; hang circles from stick or dowel as needed to make it balanced.



Spring/Seep Ecosystem

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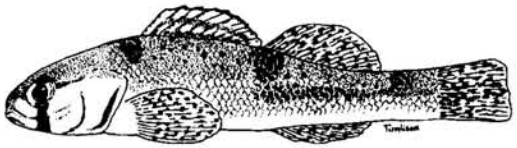
Spring/Seep Ecosystem cut-outs

Royal Snail



Slackwater Darter

Yellow-eyed Grass

River Ecosystem

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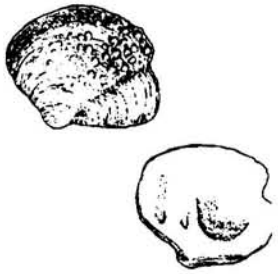
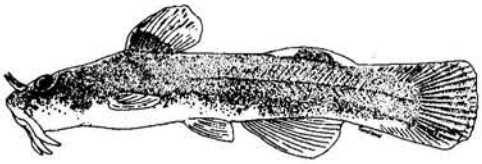
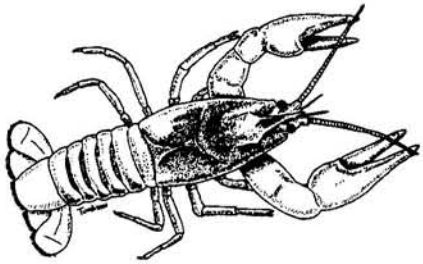
Pallid Sturgeon



Cumberland Monkeyface
Pearlymussel

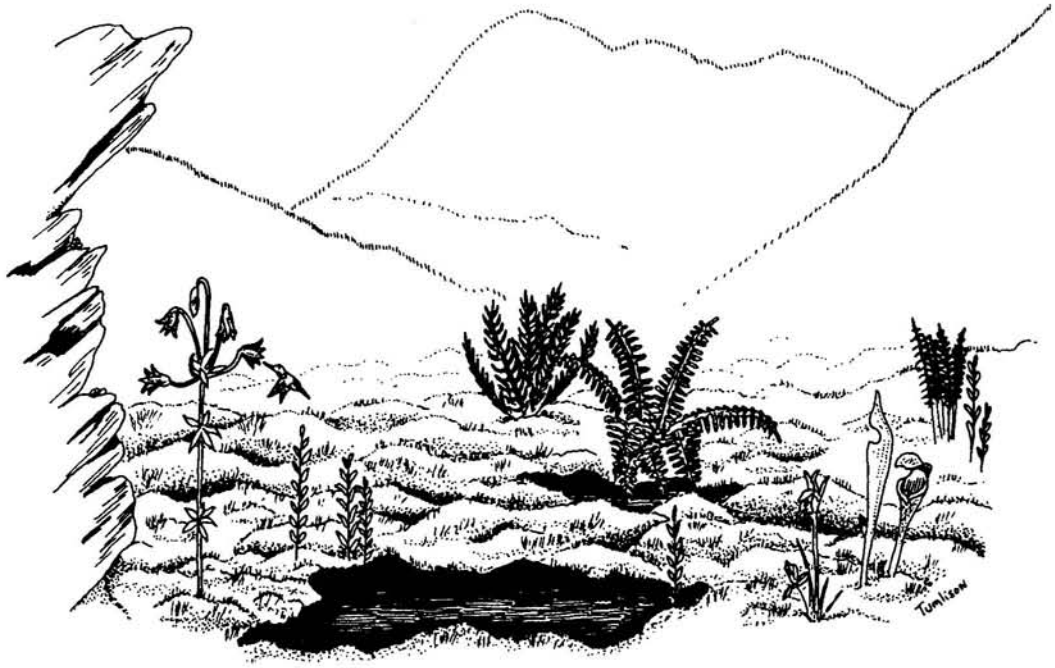


Smoky Madtom



Nashville Crayfish

Mountain Bog Ecosystem



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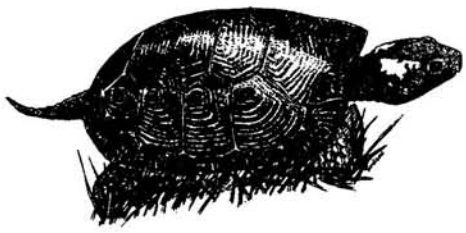
Mountain Bog Ecosystem cut-outs



Bog Turtle

Cave Ecosystem

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Cave Ecosystem cut-outs

Indiana Bat

American Hart's-tongue

Cedar Glades Ecosystem

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Cedar Glades Ecosystem cut-outs

Tennessee Coneflower

Pyne's Ground Plum

Barrens Ecosystem

Kelly Bibb

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(for flaps)

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Barrens Ecosystem cut-outs

Eggert's Sunflower

High-elevation Ecosystem

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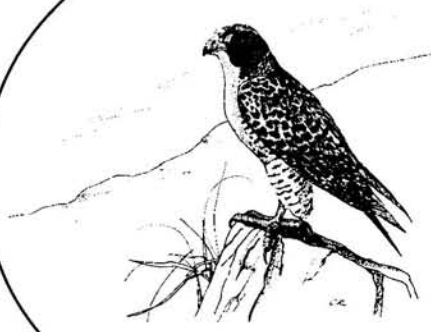
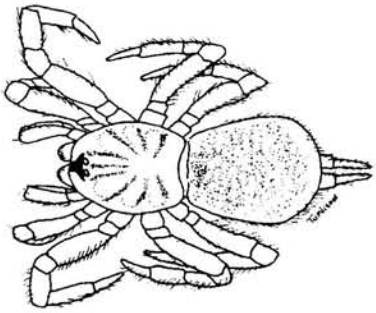
High-elevation Ecosystem cut-outs



Peregrine Falcon

Carolina Northern
Flying Squirrel



Spruce-fir Moss Spider

Rock Gnome Lichen

Ecosystem vs. Habitat

An ecosystem takes into account all living and non-living things and the interaction and interdependence among all the those things within a particular ecosystem. A habitat is the place where an animal or plant lives within its particular ecosystem.

Habitat

Habitat is defined as *the place where a plant or animal lives or the place one would go to find it.* A healthy habitat consists of food, water, shelter (or cover), and space in an arrangement that meets the species' needs. An example of a habitat suitable for humans is a house, complete with sinks, beds, and a refrigerator stocked with food. Everything a human basically needs is in this house. Within the natural world many of us are familiar with the habitat of the Northern river otter, *Lutra canadensis.* This Tennessee resident lives in rivers and bottomland hardwood forests. Its habitat is suitable and healthy when the rivers are clean and can provide fish to eat and appropriate places for constructing den homes along the riverbanks. Just as human health is linked to a healthy, clean home, a healthy otter population is dependent on clean, healthy rivers.

Ecosystems

Tennessee has an amazing variety of different ecosystems, from mountaintop high-elevation forests to mysterious underground caves. Humans, plants, animals, and other physical elements are connected by an interdependent web. An ecosystem *consists of all the living parts (plants and animals) and nonliving parts (such as soil, air, and water) in any size area, interacting and linked together by energy and nutrient flow.* The unique combinations of these interactions make each ecosystem distinctive. For example, cave ecosystems include the cave and its geological make-up, the water, lack of sunlight, and organic matter entering the cave, as well as all the plants and animals that inhabit the cave. A change in any one part of the cave ecosystem will affect all the other parts. Healthy habitats are linked to healthy ecosystems.

Ecosystems very greatly in size--from a small acre mountain bog to the large watershed the bog is part of. Ecosystems exist wherever plants, animals, and people have an interdependent relationship within the context of their physical environment. It is important to remember that small ecosystems are located within larger ecosystems. This means that what happens within one system affects what happens in every other system, with varying degrees of impact.

Today, natural resources managers practice ecosystem management for long term, sustainable natural resource conservation. This means looking at the big picture, beyond boundaries, and working closely with all land managers, both public and private. It means thinking of various resources as inter-relating parts of systems rather than as individual components to be managed separately. We all live in ecosystems and are integral parts of the interdependent web; everyone has a stake in working for diverse, healthy sustainable ecosystems, and it's going to take everyone's support and participation to make it all work.

Student Ecosystem Comparison Chart

Ecosystem Name and Loc	Major Threats to the Ecosystem
Springs/Seeps Located throughout the St	Development Logging Road construction Clearing plants Nonnative plants Underground water pollution
Rivers Located throughout the St	Polluted water run-off from land Dams Lack of riverbank plants Soil erosion Nonnative fish and mussels
Mountain Bogs Located in the Blue Ridge of east Tennessee	Changing the natural flow of water by: Draining Filling Flooding Livestock in bog Road construction Nonnative plants
Caves Located in limestone bedr central and eastern Tenne	Destruction of forests, grasslands, and cedar glades Litter Polluted water run-off from land Construction of highways and reservoirs Cave vandalism Underground water pollution
Cedar Glades Located in scattered place middle Tennessee	Urban sprawl Agriculture Careless dumping of trash Off-road vehicles
Barrens Located in scattered place middle Tennessee	Conversion to agriculture Lack of fire Nonnative plants Development Road construction Changing the natural flow of water
High-elevation Ecosysten Located in the Blue Ridge of east Tennessee	Air pollution Nonnative plants, insects, disease Climate change Trampling by hikers Rock climbing

Associated Species	Major Threats
Royal snail* Yellow-eyed grass* Large-leaved grass of Parnassus Slackwater darter* Barrne's topminnow Flame chub Trispot darter	Development Logging Road construction Clearing vegetation Nonnative plants Water withdrawal Groundwater pollution
Pallid sturgeon* Cumberland Monkeyface pearlymussel* Smoky madtom* Nashville crayfish* Spiny riversnail Water willow Riverweed Alder	Polluted runoff (non-point source pollution) Channelization Impoundments Lack of river bank vegetation Sedimentation Nonnative fish and mussels
Cinnamon fern Nashville warbler Wild azalea Golden club Cranberry Bog lemming Bog turtle*	Altering hydrology by: Draining Filling Flooding Livestock in bog Road construction Nonnative Plants
Indiana bat* Gray bat* American Hart's tongue fern* Southern cavefish Tennessee cave salamander Eastern small-footed bat Longheaded cave beetle Eastern woodrat	Destruction and degradation of forests, grasslands, cedar glades Litter Nonpoint source pollution (polluted runoff) Construction of highways & reservoirs Cave vandalism Sealing caves Groundwater pollution
Tennessee coneflower* Pyne's ground plum* Leafy prairie clover* Nashville breadroot Indigo bunting Limestone fameflower Fence lizard Six-lined racerunner	Urban sprawl Agriculture Careless dumping Offroad vehicles Nonnative pest plants
Little bluestem, switchgrass Prairie gentian Pale-purple coneflower Northern pinesnake Grasshopper sparrow Eggert's sunflower* Prairie warbler	Conversion to agriculture Lack of fire Nonnative species Development Roads Altering hydrology
American peregrine falcon Black bear Bobcat Red crossbill Snow bunting Canada warbler Carolina northern flying squirrel* Spruce-fir moss spider* Roan Mountain bluet* Spreading avens* Heller's blazing star* Rock gnome lichen*	Air pollution Nonnative plants, insects, and disease Climate change Trampling by hikers Rock climbing