

EXTINCTION: A Heavy Loss

PURPOSE

To illustrate the effect of extinction on biodiversity.

KERA CONNECTIONS to Life Science

Core Content: Organisms and Their Environments

Academic Expectations: 2.2 Patterns, 2.4 Models and Scale, 2.6 Change Over Time

Process Skills: Processing Data, Inferring

OBJECTIVES

Students should be able to:

1. identify five extinct animals that once roamed Kentucky
2. discuss reasons why species become extinct
3. relate the rate of extinction with the loss of species diversity.

VOCABULARY

Teachers may wish to discuss the following terms: endangered, evolution, extinction and extirpation.

aFIELD NOTEBOOK

Ideas for Teachers

- A. Visit a road cut or similar rock outcrop to hunt for Kentucky fossils. Online at www.uky.edu/KGS/home.htm, the Kentucky Geological Survey has information on Kentucky fossils as well as links to other sites. Make fossils using plaster of Paris or modeling clay.
- B. Add group labels to the list of federal endangered plants and animals of Kentucky. Which groups have the most extinct or extirpated species? Which groups have the most endangered species? Why are these groups so affected?
- C. Research federally endangered species that live in Kentucky. Do endangered species have anything in common? Most endangered species fit into one or more of these categories: come in conflict with people, migrate, have specific food or nesting needs, are sensitive to change, reproduce slowly, or are naturally rare. Is there one action people can take to help many endangered species recover?
- D. Ask students to identify things that people do to harm endangered species. List each item and its effect on wildlife. Examples include: "People kill me because I eat their crops" "Intended to stop malaria, pesticides kill my food" "A dam creates a lake for boating but changes the temperature of water making it too cold for me to live." Assign each student five tokens and the name of a federally listed species. Each token represents thousands of individuals in a population. Randomly draw the human actions (previously listed by the students) from a hat. If the action affects students' assigned species, they should give up one token. How long does it take for each



Program 4

ANSWERS TO aFIELD NOTES

- 1-3. Answers will vary.
4. House Bill 372, passed April 11, 1986, cited its abundance throughout the state.
5. Boone County
6. Devonian Period
7. The biggest events happened between the Permian & Triassic and the Cretaceous & Tertiary.
8. Speciation occurs continually. Swells in the Triassic Period and Quaternary Period indicate the increase in species.
9. overall loss in biodiversity
10. A $6\frac{1}{2}$ hour school day times 2 species per hour equals 13 species lost.
11. 17,520. Multiply 2 species per hour by 24 hours per day by 365 days per year.
- 12-14. habitat loss through channelization, reservoir construction, agriculture, timber harvests, urban sprawl and other changes in land use, competition from introduced species and a growing human population, pollution like pesticides and erosion, over-consumption (overcollecting, poaching) driven by wants versus needs
15. The endangered species are grouped in these classes: plants, mussels, crustaceans, insects, fish, reptiles and birds.

Snap! Crackle! Pop! Expedition

Give your students a tasty commission to survey “fossils” found in marshmallow-rice treats. Prepare marshmallow-rice treats as directed on a cereal box. Sprinkle chocolate candies, raisins, peanuts and other confections into the marshmallow-rice mix. Pour mixture over a cardboard cutout of the state of Kentucky.

Prepare a key of candies and corresponding fossil types. Have students inventory the number and type of “fossils” found in Kentucky. Which fossils represent extinct species?

For advanced students - Prepare several marshmallow-rice mixtures. Add food coloring and fossils to represent specific periods of geologic time. Layer to represent stratified sedimentary rock in corresponding regions of the state.

Making Connections

How is the Earth like a lifeboat?

**Would you like an elk to
roam in your backyard?**



Send individual or class responses to:
Kentucky Afield for Kids
#1 Game Farm Road
Frankfort, KY 40601

E-mail: ntheiss@mail.state.ky.us

species to become extinct? On which species should we concentrate time and money?

- E. THE BUCK STOPS HERE** - Have students produce handbills and campaign for their favorite endangered species. Use a “penny for a vote” election to raise funds to contribute to an endangered species’ cause.
- F. Debate the question** “Should the Endangered Species Act be reauthorized?” The Endangered Species Reauthorization Act of 1997 and the Endangered National Heritage Act are alternatives proposed in Congress.

Tasks for Students

- 1.** Perform a play casting extinct species from Kentucky’s “Lost World.”
- 2.** Conduct a baseline inventory of plant and animal species living on school grounds to compare future population trends.
- 3.** Create a “Top Ten” list of simple things you can do to protect endangered species.
- 4.** Analyze the strengths and weaknesses of the federal endangered species list. Should Kentucky have a state endangered species list? An unofficial list is maintained by the Kentucky Nature Preserves Commission and the Kentucky Academy of Science.
- 5.** Design an experiment to determine whether the American burying beetle still lives in Kentucky.

WILD THINGS FOR TEACHERS

Learn more about endangered species and other environmental issues through the Kentucky Association for Environmental Education (KAEE). Membership information is available from: KAEE, 3200 Tucker Station Road, Louisville, KY 40299.

RECOMMENDED RESOURCES

- * *Teacher’s Guide to Kentucky’s Environment*. Kentucky Environmental Quality Commission: Frankfort, KY, 1993. A companion to *State of Kentucky’s Environment: A Report of Progress and Problems*, information may be obtained through the KEQC, 14 Reilly Road, Frankfort, KY 40601-1132. 502/564-2150.
- * *Endangered Species: Wild & Rare*. NatureScope series from the National Wildlife Federation, 1400 16th Street, NW, Washington, D.C., 1989.
- * Glass, Phil. “Pondering Kentucky’s Rare, Threatened and Endangered Species” *Kentucky Afield - The Magazine*. Jan./Feb. 1992, pp. 13-16.

ADDITIONAL ACTIVITIES

- * Project WILD activities “Here Today, Gone Tomorrow” “Environmental Barometer” and “Deadly Links”
- * Project WILD Aquatic activities “Deadly Waters” and “To Dam or Not to Dam”
- * Project Learning Tree activity “Living on the Edge”
- * “Peregrines Over Kentucky” *Kentucky Afield for Kids*. January 1996.

EXTINCTION: A Heavy Loss

BIODIVERSITY IN ANCIENT TIMES

The Earth is an ever-changing planet. Life on earth also changes with the times. Fossils, embedded in sedimentary rock layers, reveal clues to Kentucky's past biodiversity. **Paleontologists** (fossil scientists) have an incomplete picture of Kentucky's history because much rock has eroded away.



aFIELD NOTES

December 3, 1997

1. How old are the rocks under your feet?

2. Which life forms have fossilized in your area?

3. Sketch one of the fossils commonly found in your region.

4. Why do you think brachiopods were named as Kentucky's state fossil?

Using a state highway map, locate Big Bone Lick State Park.

5. In which Kentucky county were woolly mammoth bones discovered?

Geology in Kentucky

Devonian Period



THE KNOBS

- * includes the Falls of the Ohio
- * Silurian and Devonian Periods
- * shallow tropical sea
- * brachiopods, trilobites, corals, arthrodire fish

Ordovician Period

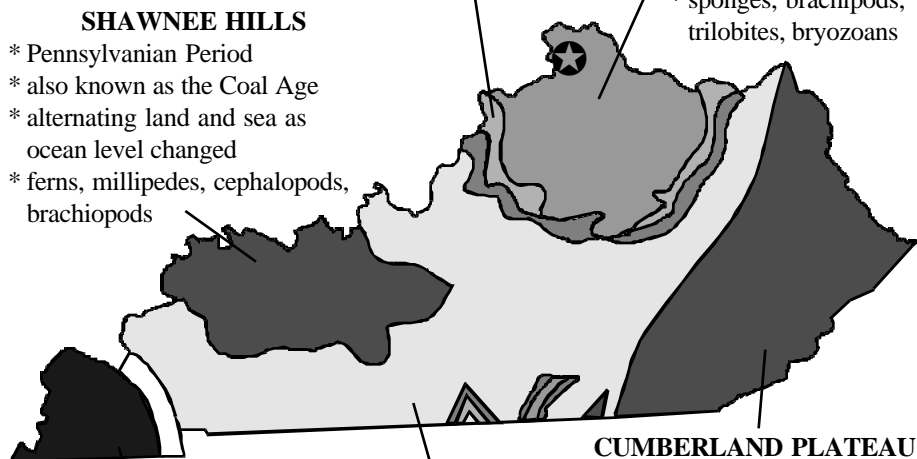


BLUEGRASS

- * oldest rock exposed
- * Ordovician Period
- * shallow tropical sea
- * sponges, brachiopods, trilobites, bryozoans

SHAWNEE HILLS

- * Pennsylvanian Period
- * also known as the Coal Age
- * alternating land and sea as ocean level changed
- * ferns, millipedes, cephalopods, brachiopods



COASTAL PLAIN

- * younger rock formations exposed
- * Cretaceous and Tertiary periods
- * only possible site for dinosaur fossils
- * sediments not yet cemented into rocks
- * coalified tree trunks, limbs and leaves

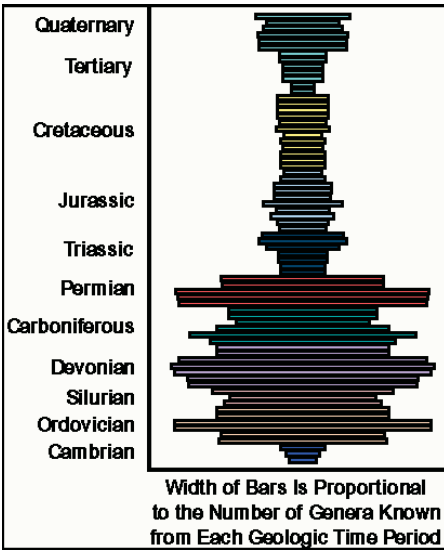
CUMBERLAND PLATEAU

- * Pennsylvanian Period
- * also known as the Coal Age
- * alternating land and sea as ocean level changed
- * brachiopods, horseshoe crabs, insects, reptiles, scale trees

PENNYROYAL

- * Mississippian Period
- * shallow tropical sea and lowlands
- * crinoids, sharks, brachiopods, ferns, amphibians

All geological drawings courtesy of Kentucky Geological Survey, Stephen Greb



Paleontologists use spindle graphs to measure the diversity of organisms through time.

6. During which geologic time period were the most species of brachiopods found?

7. When did mass extinctions occur?

8. Is it possible for new species to form? Use the spindle graph to explain your answer.

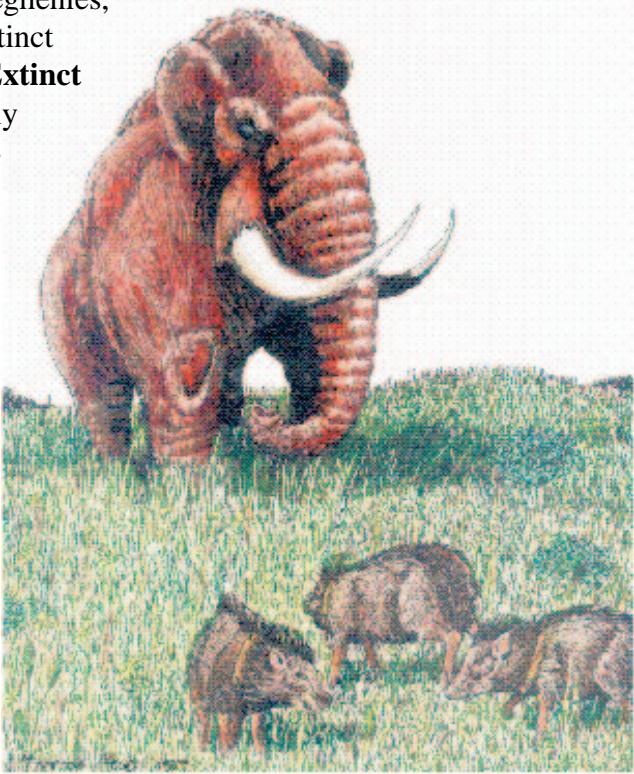
9. If the rate of extinction is greater than the rate by which new species evolve, what is happening to the Earth's biodiversity?

THOMAS JEFFERSON SURVEYS THE WILDERNESS

When “elephant” bones were discovered at Big Bone Lick, President Thomas Jefferson commissioned a scientific expedition. Taking inventory is an important step in determining the value of natural resources. The surveying party found bones from bison, musk ox, caribou, elk, deer, wolf and bear.

Although no live elephants were found west of the Alleghenies, the fossils of many extinct species were found. **Extinct** species, like the woolly mammoth and American mastodon, have died out. Remains of other extinct animals found at Big Bone Lick include the stag moose, ancient bison, flat-headed peccary, North American horse and giant ground sloth.

Mammoth and peccaries during Quaternary Period.



EXTINCTION IS A NATURAL PROCESS

Millions of species have become extinct through natural causes. Movement of continents over the poles and volcanic eruptions trigger climatic changes around the globe. Huge glaciers may form causing sea level to change. Sometimes comets and meteorites shower the Earth's surface. These catastrophic events can cause the majority of life on earth to become extinct. During one such **mass extinction**, more than 85% of the species at that time, including dinosaurs, died out.

Paleontologists have recognized several patterns of extinction over geologic time. First, both land and ocean dwellers become extinct. Tropical animals are most likely to die out, while land plants are least likely. About 26 million years occurs between each mass extinction event. The last mass extinction happened about 11,000 years ago during the ice age.

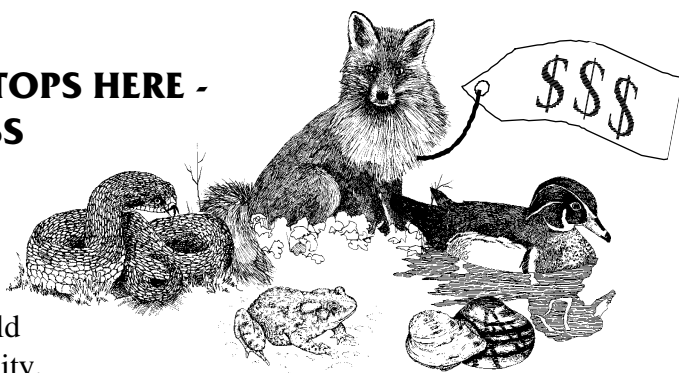
THE HUMAN FACTOR

In the cosmic order of events, mass extinction should not occur again for many years. Yet in the last century, the passenger pigeon, Carolina parakeet and ivory-billed woodpecker have disappeared forever. Biodiversity experts estimate that two to three species are lost every hour somewhere on the planet. What is happening to wildlife?

By the year 2000, the world's human population is expected to reach six billion. Fulfilling human needs often comes at the expense of other species. The more people, the more species are affected

THE BUCK STOPS HERE - A HEAVY LOSS

It would be difficult to put a price tag on all the items that a parent gives a child - housing, electricity, food, toys, washing clothes, security, love . . . Assigning a value to a species is impossible too. Plants and animals helped past generations, contribute to present generations and have unknown value to future generations. For example, medical breakthroughs may come from the American bison -- one animal that never gets cancer.



Though people have not surveyed all the life forms on Earth, we do know they are interrelated. When one animal becomes extinct, it can cause up to thirty other plants and animals to die out. Once wildlife is extinct, we can never get it back. That is the heaviest loss.

IS THERE HOPE?

Once people recognize a problem, they can work on a solution. Some wildlife species have very low populations or have trouble reproducing. Other plants and animals have lost a significant amount of habitat upon which they depend for food, water and shelter. People label these species **endangered** or on the verge of extinction.

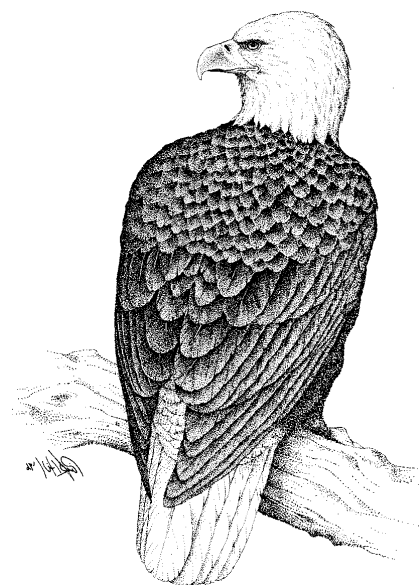
The Endangered Species Act of 1973 helps species listed as endangered or **threatened** to become endangered. A recovery plan is developed and critical habitat is protected. Bald eagles soar to the top as a success story. Only 1200 nesting pairs of eagles were sighted in the lower 48 states in 1969. Their eggshells were so thin that young eaglets rarely hatched. Pesticides, like DDT, were identified as the cause of thin eggshells. In 1972, DDT was banned from most uses in the United States. Through laws and other conservation strategies, bald eagles had rebounded to 2200 nesting pairs in 1989. In 1995, the bald eagle was downlisted to threatened.

Is there hope? The answer lies in you!

10. If two species become extinct per hour, how many species will disappear during one school day?

11. How many species may be lost in the next year?

12-14. Name three human activities that cause endangerment.



Federal Endangered Plants and Animals in Kentucky

E = Endangered
T = Threatened
PT = Proposed Threatened
X = eXtirpated from Kentucky or eXtinct

American chaffseed	<i>Schwalbea americana</i>	X
Braun's rock cress	<i>Arabis perstellata</i>	E
Cumberland rosemary	<i>Conradina verticillata</i>	T
Cumberland sandwort	<i>Minuartia cumberlandensis</i>	E
Eggert's sunflower	<i>Helianthus eggertii</i>	T
Price's potato-bean	<i>Apios priceana</i>	T
Running buffalo clover	<i>Trifolium stoloniferum</i>	E
Short's goldenrod	<i>Solidago shortii</i>	E
Virginia spiraea	<i>Spiraea virginiana</i>	T
White-haired goldenrod	<i>Solidago albopilosa</i>	T

Clubshell	<i>Pleurobema clava</i>	E
Cracking pearlymussel	<i>Hemistena lata</i>	X
Cumberland bean	<i>Villosa trabalis</i>	E
Cumberlandian combshell	<i>Epioblasma brevidens</i>	E
Cumberland elktoe	<i>Alasmidonta atropurpurea</i>	E
Fanshell	<i>Cyprogenia stegaria</i>	E
Fat pocketbook	<i>Potamilus capax</i>	E
Little-wing pearlymussel	<i>Pegias fabula</i>	E
Northern riffleshell	<i>Epioblasma torulosa</i>	E
Orange-foot pimpleback	<i>Plethobasus cooperianus</i>	E
Oyster mussel	<i>Epioblasma capsaeformis</i>	E
Pink mucket	<i>Lampsilis abrupta</i>	E
Purple cat's paw	<i>Epioblasma obliquata</i>	E
Ring pink	<i>Obovaria retusa</i>	E
Rough pigtoe	<i>Pleurobema plenum</i>	E
Tan riffleshell	<i>Epioblasma walkeri</i>	X
Tubercled-blossom	<i>Epioblasma torulosa</i>	X
Winged mapleleaf mussel	<i>Quadrula fragosa</i>	X

Mammoth cave shrimp	<i>Palaemonias ganteri</i>	E
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American burying beetle	<i>Nicrophorus americanus</i>	E
Blackside dace	<i>Phoxinus cumberlandensis</i>	T
Duskytail darter	<i>Etheostoma percnurum</i>	E
Palezone shiner	<i>Notropis albizonatus</i>	E
Pallid sturgeon	<i>Scaphirhynchus albus</i>	E
Relict darter	<i>Etheostoma chienense</i>	E

Copperbelly water snake	<i>Nerodia erythrogaster</i>	PT
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American peregrine falcon	<i>Falco peregrinus</i>	E
Bald eagle	<i>Haliaeetus leucocephalus</i>	T
Interior least tern	<i>Sterna antillarum</i>	E
Red-cockaded woodpecker	<i>Picoides borealis</i>	E
Eskimo curlew	<i>Numenius borealis</i>	X
Ivory-billed woodpecker	<i>Campephilus principalis</i>	X
Kirtland's warbler	<i>Dendroica kirtlandii</i>	X
Bachman's warbler	<i>Vermivora bachmanii</i>	E
Piping plover	<i>Charadrius melodus</i>	T
Wood Stork	<i>Mycteria americana</i>	E

Eastern cougar	<i>Felis concolor</i>	X
Gray bat	<i>Myotis grisescens</i>	E
Gray wolf	<i>Canis lupus</i>	X
Indiana bat	<i>Myotis sodalis</i>	E
Red wolf	<i>Canis rufus</i>	E
Virginia big-eared bat	<i>Corynorhinus townsendii</i>	E

If reauthorized, 120 candidate species will be reviewed for the next Endangered Species List.