Natural History: Biological Diversity

BIological diversity, or biodiversity, refers to the variety and variability of living organisms on the planet. Ecologists tend to focus on three levels of biological diversity: genetic, species, and ecosystem diversity.

Species diversity is the most common level of diversity. Species is a word used in biology to refer to a type of organism different from all others. Species diversity is a measure of the number of species at a location. It varies greatly from place to place.

Ecosystem diversity is a complex level of biodiversity. An ecosystem is a system in which a community of organisms and their physical environment interact. Each ecosystem (e.g., a park) contains characteristic plants and animals. Some examples of ecosystems are grasslands, deserts, rainforests, conifer forests, and deciduous forests. In a large area, there may be several different ecosystems. This is ecosystem diversity.

Genetic diversity is a less obvious level of biological diversity. Genes are inherited from parents and transmitted to offspring. Genes affect how organisms look, and how they work. Genes also make each individual at least a little different from every other member of the species. These differences are what we call genetic diversity.

Today there is great concern about the loss of biodiversity. In the foreword to *Technologies to Maintain Biological Diversity,* John H. Gibbons, Director of the Office of Technology Assessment, states, "The reduction of the Earth's biological diversity has emerged as a public policy issue in the last several years. Growing awareness of this planetary problem has prompted increased study of the subject and has led to calls to increase public and private initiative to address the problem.

"One major concern is that loss of plant, animal, and microbial resources may impair future options to develop new important products and processes in agriculture, medicine, and industry. Concerns also exist that loss of diversity undermines the potential of populations and species to respond or adapt to changing environmental conditions. Because humans ultimately depend on environmental support functions, special caution should be taken to ensure that diversity losses do not disrupt these functions. Finally, esthetic and ethical motivation to avoid the irreversible loss of unique life forms has played an increasingly major role in promoting public and private programs to conserve particular species or habitats."

HABITAT ALTERATION: Five hundred years after Columbus came to the New World, America's plants and animals are seriously depleted. More than 140 kinds of animals and approximately 60 kinds of plants have been declared extinct. Another 204 kinds of plants are probably extinct. The U.S. Fish and Wildlife Service (FWS) has listed 464 kinds of plants and animals as threatened or endangered; 3,800 additional kinds of plants and animals

are in such danger that the FWS has designated them as "candidates" for listing as endangered or threatened.

The leading cause of these extinctions has been habitat alteration by humans for purposes of converting land to more immediately recognized, productive uses. Habitat alteration by humans is also responsible for endangering plants and animals.

Encroaching on habitat has been the principal cause of decline of a number of different kinds of organisms. In the Southwestern United States, logging operations threaten the Venus' flytrap. The Houston toad is endangered by loss of habitat from urban-industrial expansion. Attwater's prairie chicken is in trouble because of overgrazing and cultivation of its prairie habitat.

It is difficult to understand the full meaning of the term "habitat alteration" without having a good understanding of the terms "habitat" and "niche."'

Habitat is the place where an organism lives — its home address. It is the organism's physical living place. The niche is a plant's or an animal's profession, occupation, or job — it's role in life. The niche of an organism is about relationship, its relationship to the place where it lives, as well as to other organisms living there.

The profession, or niche, of an organism has a great deal to say about where the organism lives. The niche of the earthworm includes feeding on decaying plant and animal parts in the soil. However, there are many things that have to be right for the earthworm to occupy that niche: climate, soil conditions, and natural enemies. But the niche is about more than food; it is everything the organism must do to survive and to leave its young.

Another perspective on niche is provided by the work of Robert MacArthur. He studied five different kinds of warblers, which live in the spruce forests of Maine and Vermont. The five birds eat roughly the same kind of food — spruce budworms. MacArthur's painstakingly careful research showed that the five warblers find their food at different places in spruce trees. One habitat; five different niches. Each bird had different behaviors and hunting methods, allowing it to survive and leave babies.

EXTINCTION: Extinction is a way of life for all organisms on our planet. Species appear, and then in time, die out. However, once an organism disappears — becomes extinct — it never reappears again.

The rate of extinction has changed. Never before, in all of the earth's long and varied history, has there been the massive disappearance of plants and animals that is occurring today. Within the next 30 years, perhaps as many as one million different plant and animal species will vanish forever. This is a loss of two to three species an hour. According to Paul Opler, "since the arrival of the Puritans at Plymoth Rock over 500 types of animals and plants have become extinct." Contrast this with three species per hundred years during one 3,000-year period of Ice Age extinction. During the demise of the dinosaurs, the rate of loss was only one species every 10,000 years.

Why are we losing so fast? It is because of direct or indirect human interference, in the form of habitat

loss, commercial exploitation, extermination of feared species, and pollution. While pollution and over-harvesting have had some effect, the main reason for this greatly accelerated and unnatural pace of extinction is habitat loss. This is especially true in the tropics, here at least half of all life forms on earth may reside.

OBJECTIVES

After completing this exercise the student will be able to

1. learn what biological diversity means
2. learn that varied habitat is the key to biodiversity
3. recognize factors that determine habitat such as elevation, aspect, slope, soil type, and rainfall
4. be able to name threats to habitats from human activities
5. be able to identify three factors involved in the extinction of a species and describe the finality of extinction
6. recognize the importance of national parks in protecting habitat

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Language Arts Standard 3 – Listening and speaking
Science Standard 4 – Life science

GROUP SIZE: 5 to 30

DURATION: 1 hour

SETTING: classroom, museum, outdoors

MATERIALS: Information from introduction to biological diversity on page 87, "The Educator's Role in Biological Diversity" page 91, and activities in this section.

Educator's Outline for

BIOLOGICAL DIVERSITY

PROCEDURE: As a pre-site activity, perhaps in a classroom setting, go over the background information from the biological diversity curriculum. Discuss what is meant by biological diversity and habitat. Talk about the characteristics of habitat (food, water, shelter, and space), and why certain plants and animals live in certain areas.

Discuss how humans fit into the biodiversity equation. How have habitats changed due to human activities? Why is biodiversity important? What role do national parks play in protecting habitats?

Continue the curriculum in the field, perhaps at either the Montezuma Well Environmental Study Area (ESA) or another site (e.g. schoolyard). Have students describe the habitat and ask them to guess what types of animals and plants live there. At the Well, compare the pasture habitat with the streamside riparian habitat along Wet Beaver Creek.

Observe the changes in habitats; ask students to speculate about the factors that contribute to these changes. Where is there more biodiversity? Where is there less? Why?

THE EDUCATOR'S ROLE IN BIOLOGICAL DIVERSITY ... A MESSAGE FROM THE NATIONAL PARK SERVICE

Dear Teacher and Interpreter.

Crows, jays, warblers, pelicans, sparrows, ducks, eagles — all different varieties of birds. Lions, tigers, bears, mice, rabbits, dogs — all different varieties of mammals. Maples, elms, pines, palms, oaks — all different varieties of trees. These you can see, but there are thousands of different varieties of micro-organisms that you can't see that are the beginning of the food chain for the animals, birds and plants. The earth abounds with variety. Almost anywhere you travel you will find an incredible variety of plants and animals. This variety of life is called biological diversity. It includes ecosystems and their interacting communities of plants, animals, and microorganisms, as well as species, and their genetic composition and variation.

Why is biological diversity important? Why should we care about preserving as much of it as possible? Our lives, and life on earth as we know it, are dependent upon the complicated interactions and interdependency of the myriad species of life forms with which we share this planet. Ecosystems are composed of both living and non-living elements. Control of climate and the quality of the atmosphere are services provided freely by natural ecosystems. So too are the cycling of nutrients and the natural disposal of wastes, pollination and the supply of foods, the maintenance of soils, and water storage in forest watersheds.

This renewal and recycling process is the power nature has to cleanse and rebuild ecosystems, but there is a balance that must be maintained and, as good stewards, we must maintain species of plants and animals that affect our lives everyday and in ways few people realize. Foods that we eat, medicines we take for illnesses, industrial products we use, and pets and houseplants, may all owe their origin to living wild plants and animals. Developed

and developing countries alike are dependent upon a species richness embodied in a common, shared heritage of biological diversity It has been stated that the loss of biological diversity is second only to nuclear warfare in its threat to human and other life on this planet. This loss of the diversity of life, and other related environmental concerns, may well be the most significant issue facing mankind as we approach the beginning of the 21st century. As the 20th century ends, we face the loss of many species which were present at its beginning.

A critical part of the problem is that we just don't know how many species of living plants, animals, and microorganisms there are. A few years ago five to six million would have been a common estimate. Today, a conservative estimate would be thirty million plus. When you don't know how much there is of something, you can't accurately assess what you're losing. The tropical areas of the world contain the greatest biological diversity, and it is there where the greatest loss of plants, animals and microorganisms is occurring.

The threats to biological diversity include the loss of places where plants and animals naturally grow; pollution; direct elimination of animal and plant species; introduction of alien species; and climate change, especially global warming. Our hope — the earth's hope, lies in a concerned, educated, and motivated public. It begins with education. Hence, we are happy to endorse and support this environmental education curriculum on biological diversity. The future is in our hands, our hearts, our minds.

James M. Ridenour
Director
National Park Service

Paul C. Pritchard
President
National Parks and
Conservation
Association

"...When the last individual of a race of living things breathes no more, another Heaven and another Earth must pass before such a one can be again."

—W. BEEBE (1877-1972)

Educator's Outline for

AND THEN THERE WERE NONE

This is a pre-visit activity

OBJECTIVES

After completing this exercise the student will be able to

1. describe the impact of humans on other living things as a result of human social, economic, and political activities
2. define the terms endangered and extinct

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 20 to 30

DURATION: 1 to 2 hours

SETTING: Classroom

MATERIALS FOR THE CLASS: "I AM" and "SURVIVAL" student activity sheets

MATERIALS FOR EACH STUDENT: Tape and 6 small slips of paper

PROCEDURE:

1. Copy and cut the I AM and SURVIVAL FACTORS into cards. Have the students arrange their chairs in a circle. Tape the name of an animal or plant to their blouses/ shirts. The plants and wildlife found on the Activity Sheet I AM are mostly endangered species. They are all native to the United States. (If you prefer, have students choose plants and animals growing in their area.)

2. Distribute six slips of paper to each student. Tell them that this represents a population of organisms. If necessary, review the population concept. Write the word POPULATION on the chalkboard. Remind them that a population is two or more organisms of the same kind; that there are plant and animal populations; and that the size of a population is determined by the number of individuals. The student populations are all the same size. Point out that organism size makes no difference in the size of populations. Population is about numbers of organisms. Tell them that each of their slips represents millions of organisms.

3. Tell students that you are going to read some statements. Give them the following directions:

"Everyone stand up in a circle. Each time I read a statement that limits or reduces your chances of survival, put one of your slips on the floor in front of you. Whenever I say 'human population growth,' everyone turns in a slip. When you have two slips left, sit down on the floor and say, 'I'm in big trouble.'"

Continue to play until everyone is sitting.

4. Discuss the game, asking questions such as:
   How many of you have slips left? How many have none?
   Is this game life-like? Why, or why not?
   What are the important ideas in this game?

5. Write the words EXTINCT and ENDANGERED on the chalkboard. Tell students that their populations became endangered when they became small in number. Endangered refers to any population of plants or animals in danger of extinction. There are still some left. Extinction is final. The plant or animal is "gone forever."

6. Ask students whether they have even seen a building being torn down, or whether they have ever lost something they have never found. If so, they have some idea and feeling about extinction.

Tell students there is an official list of endangered species. Plants and animals are placed on this list after careful study and review by the Office of Endangered Species, U.S. Fish and Wildlife Service.

7. Summarize this lesson with a discussion. Use these kinds of questions:

- What are factors that influence the survival of populations of plants and animals? Can you of some factors that this game did not consider?
- Does this game contain any facts? What are they? Are they accurate? How could you find out?
- Did populations have any choices? Why or why not?
- How could this game be changed to make it even more like real life?
- How would you change this game to have winners? (Does this game have any winners?)
- Do populations lose this game by chance? Is this life-like?

I AM

I AM a Gray Wolf (mammal)	**I AM** an American Crocodile (reptile)
I AM a Florida Panther (mammal)	**I AM** a San Francisco Garter Snake (reptile)
I AM a Utah Prairie Dog (mammal)	**I AM** a Houston Toad (amphibian)
I AM a Key Deer (mammal)	**I AM** an Indiana Bat (mammal)
I AM a Woodland Caribou (mammal)	**I AM** a Grizzly Bear (mammal)
I AM a Northern Swift Fox (mammal)	**I AM** an Alabama Beach Mouse (mammal)
I AM a Peregrine Falcon (bird)	**I AM** a Sea Otter (mammal)
I AM a Brown Pelican (bird)	**I AM** a Fresno Kangaroo Rat (mammal)
I AM a Hawaiian Honeycreeper (bird)	**I AM** a Bald Eagle (bird)

I AM a California Condor (bird)	I AM a Green Pitcher (plant)
I AM an Eskimo Curlew (bird)	I AM a Prairie Bush Clover (plant)
I AM a Hawaiian Moorhen (bird)	I AM a Short's Goldenrod (plant)
I AM a New Mexico Ridge-Nosed Rattlesnake (reptile)	I AM a Noonday Snail (snail)
I AM a Red Hills Salamander (amphibian)	I AM a Nashville Crayfish (crustacean)
I AM an Apache Trout (fish)	I AM a Smith's Butterfly (insect)
I AM a Bonytail Chub (fish)	I AM a Minnesota Trout Lily (plant)
I AM a Judge Tait's Mussel (dam)	I AM a Furbish Lousewort (plant)
I AM a Delta Green Ground Beetle (insect)	I AM a Ruth's Golden Aster (plant)
I AM a Tree Cactus (plant)	I AM a Virginia Round Leaf Birch (plant)

SURVIVAL FACTORS

People are afraid of you or think you are a pest. They trap and shoot you.	Human population growth increases.
Your habitat is used for recreation — snowmobiles, off-the-road vehicles, beach buggies.	Your habitat is threatened from oil/ gasoline spills, ocean drilling, or run-off from gas stations into wetlands, streams, and ponds.
A trapper has set out some traps and you have gotten caught in one.	Silt from logging and agriculture pollutes the water.
Your habitat is used for construction projects-highways, housing, shopping centers.	A poacher has shot you illegally.
Your marsh is drained.	A city expands and builds an office complex in your meadow.
A dam was built and the valley where you live is now under deep water.	An oil tanker has spilled thousands of gallons of oil into the ocean.
A timber company has cut an area in patches, leaving critical habitat for you.	Chemicals used on lawns have been washed into the water.
A timber company has clear-cut an area where you find food.	An oil company has paid to test the effect of oil drilling on an area where you live.
A cabin is built as a vacation home in your forest.	New zoning allows development nearby, but protects your critical habitat.
A fire has burned your forest.	Pesticides have polluted the water.

OBJECTIVES

After completing this exercise the student will be able to

1. describe an organism
2. describe living and non-living environmental factors that may affect an organism
3. hypothesize on the effects on environmental factors
4. define an organism as any living thing, plant or animals

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 1 – Life science
Science Standard 4 – Life science
Language Arts Standard 3 – Listening and speaking

GROUP SIZE: 20 to 30

DURATION: 2 hours

SETTING: Outdoor

MATERIALS FOR THE CLASS: "FINDING OUT WHAT LIVES HERE" student activity sheet

MATERIALS FOR EACH STUDENT: magnifier, metric ruler, plastic or paper cup, 5 to 10 plastic spoons, 5 to 10 bug boxes/ plastic cups. Optional for aquatic habitats: nets

Educator's Outline for

ORGANISM SEARCH

This is a pre-visit activity

PROCEDURE:

1. Choose an outdoor site for students to study. It should be within walking distance and be as diverse as possible.

2. Divide the class into teams of two. Tell students that they will be exploring an outdoor study area to find out what lives there. Distribute two copies of the Natural History Activity Sheet, FINDING OUT WHAT LIVES HERE, to each team and review it with them.

3. Once outside, point out the boundaries of the study site. There is no reason to dig up plants. Some animals may be easier to study if they are temporarily housed in either a bug box or a cup. Emphasize that one animal is enough. Tell students that you want them to find and observe as many different plants or animals as they can. Ask team working close to one another to make different choices.

4. When the class is finished, have the teams return any plant parts or animals to where they were found. (Students may have used bug boxes or cups for pondweed, snails, crickets, ants, earthworms, and isopods.)

5. When you return to the classroom, have the teams describe what they have found.

6. Summarize the work by asking these kinds of questions:

- Did we get them all?
- If we went back out again do you think we could find new plants or animals? Where would you look?
- If we were to do this at the national park, what would you expect to find?

- What are some of your observations?
- What are some examples of living environmental factors? What effect do you think they might have?
- What are some examples of nonliving environmental factors? What effect do you think they have?
- How many different kinds of environmental factors did we find? Which are there more of, living or nonliving?

7. Tell students that any living thing, plant or animal, is an ORGANISM. Write it on the board where everyone can see it.
   - How many organisms did we find?
   - How many different kinds of plants? Animals?
   - Did we find more plants or animals?
   - If we were to spend more time doing this study, what other organisms do you think we would see?
   - Suppose you were to conduct this work in a field or wooded area at the national park. Would you expect to find the same kinds of organisms? Why, or why not? Would it be easier to find different kinds of organisms? Why, or why not?
   - How could we change the environment to see more organisms? (What if we were to add a bird feeder to the schoolyard a plant or garden?)

FINDING OUT WHAT LIVES HERE

Team Members:

1. Choose a plant or animal to observe.

   a. If you know the plant or animal, name it. If you don't know its name, invent one that describes either what it looks like or something that it does.

   b. Describe the plant or animal. Use the other side to make a drawing.

   c. Describe the place the plant or animal lives — its habitat. Is it sunny, shady, in the open, surrounded by many plants, on the ground, 10 feet in the air, 30 feet in the air, under a rock, in a moist or dry place, under water, other?

2. What might change this animal or plant home? Give three examples and tell how the habitat might change.

   a.

   b.

   c.

Educator's Outline for

SPACE FOR A NICHE

This is a pre-visit activity

OBJECTIVES

After completing this exercise the student will be able to

1. describe the niche of a park species
2. identify a critical feature of that organism's niche
3. cite threats to biological diversity and ways that preservation of biological diversity can be promoted

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 20 to 30

DURATION: 1 to 2 hours

SETTING: Classroom, outdoors

MATERIALS: Class set of 3 x 5 inch cards, student activity sheets "NICHE OF A BALD EAGLE," "SOME BALD EAGLE NICHE DIMENSIONS" and "NICHE NOTES"

BACKGROUND: Niche has been defined as all interrelationships of an organism with its environment. Fairly large lists follow from such a definition! They suggest a complexity of relationships that few of us can even begin to appreciate or understand.

PROCEDURE: Develop a set of cards that describes the niche of an organism; endangered, if possible; and/or one for which the park provides critical habitat. There should be one niche characteristic per card. One of the cards should have name of the organism. This card is for you or for one of the students. Some of the niche dimensions of a representative species, the bald eagle northern habitats, have been provided as an example that you may choose to use. (Activity Sheets: NICHE OF A BALD EAGLE and SOME BALD EAGLE NICHE DIMENSIONS provide some background.) The niche dimensions emphasize nesting habitat. Fall and winter habitat are important, too. Add these details if you can.

1. Gather students around you. Tell them that you have in your backpack the niche of an organism.

3. Have students quickly take a card from your backpack and form a circle, shoulder-to-shoulder. Tell students this is your niche. Have them quickly read their card aloud and as they finish; you squeeze into the circle and ask them to guess who you are. Students will be guessing what animal belongs to the niche described.

4. Ask, "What might happen if ...?" (E.g. the food of eagles is polluted by chemicals, or if the eagles were disturbed by logging operations.) The card holder(s) can either step away from the circle or collapse to the ground. A gap is left. Children may think that this gap can be hurdled or breached somehow — after all, it

appears quite small. This isn't the point. It's either gone or damaged. The right combination of things has been changed and the organism is in trouble. In the case of the eagle, you can recount the history of the bald eagle and the role of parks in its recovery. The student playing the part of "critical feature" can fill the gap and make the circle whole, emphasizing the role of the park in the preservation of biological diversity.

5. Ask students to give you some examples of threats to biological diversity. Then ask them to list some ways in which they can contribute to preserving biological diversity.

NICHE OF A BALD EAGLE

The bald eagle is the only eagle unique to North America. According to the U.S. Fish and Wildlife Service, thirty-five years ago, bald eagles were in danger of extinction. Loss of habitat, shooting for feathers and poisoning by the pesticide DDT all contributed to the near demise of this bird. Since that time, DDT has been banned in the United States and the bald eagle has been protected by the Endangered Species Act and other federal laws. Today, thanks to the efforts of the American people, the bald eagle once again soars the skies above our country. Because the bald eagle is doing so well in the United States, the U.S. Fish and Wildlife Service has proposed to remove it from the list of threatened and endangered species.

The greatest threat to the bald eagle's existence arose with the widespread use of DDT after World War II. DDT was sprayed on croplands throughout the country and residues washed into lakes and streams. There, they were absorbed by aquatic plants and small animals that were eaten by fish. The contaminated fish, in turn, were consumed by eagles, contaminating them. DDT interfered with the development of strong eggshells. Bald eagles and many other bird species began laying egg whose shells were so thin that they broke during incubation or otherwise failed to hatch. By the early 1970s, there were perhaps less than 3,000 left in the lower 48 states. This chemical was banned for most uses in the U.S. in 1972. Since the banning of DDT, bald eagle populations have been increasing, though more than 90% of the nesting places are centered in populations in Florida, the Chesapeake Bay area, Maine, the Great Lakes, and the Pacific Northwest. While DDT is not used in the U.S., it is still used in other countries. There is evidence that some of it is deposited in the U.S. through the air. The effects of these levels of contaminants on reproductive success in bald eagles, if any, are not known. There is some evidence that other persistent contaminants (e.g., polychlorobiphenyls and mercury residues), as well as non-persistent, but moderately to highly toxic, contaminants may cause adverse effects on bald eagle populations.

In a major effort to return eagles to the world, the U.S. Fish and Wildlife Service established a captive colony. The eagles' first clutch of eggs was removed and artificially incubated.

The eagles then laid a second clutch themselves. Two methods of reintroduction to the wild were used. In one, 3-week-old eaglets were placed in the nest of adult pairs whose own eggs failed to hatch. The "foster" parents readily adopted the chicks and raised them as their own.

The ancient falconry technique known as "hacking" was also used. The term comes from the hack — the board on which the hawk's meat was laid, and to which it returned. At 8 weeks of age, birds were placed on human-made towers, located in wilderness areas where eagle populations are low. Great care was taken to ensure that the birds have no direct human contact. Gradually, over a period of several weeks, progressively less food was provided to force the young eagles to hunt their own prey and learn to fend for themselves.

From fewer than 3,000 birds and only about 400 known active nests in the early 1970s, there are now more than 5,000 bald eagles and 1,400 breeding pairs in the continental United States.

Why pay so much attention to a species that is clearly on the comeback? There are a variety of reasons. The bald eagle is sensitive to environmental conservation, habitat deterioration, and human harassment. An interesting answer is found in "Restoring the Bald Eagle" (American Scientist, May-June 1988). One of the authors is Dr. Ted Simons, Gulf Island National Seashore, NPS. Simons and his associates note that bald eagles "are not on the verge of extinction, and when viewed in the context of global conservation needs and of other critically endangered species, the attention may seem misplaced. In fact, it is precisely the symbolic nature of widespread species like the bald eagle — with their ability to capture the imagination of the public — that makes them such worthwhile conservation investments. As symbols of wilderness and of the freedom wilderness represents, bald eagles have the unique capacity to inspire people and to foster a sympathetic attitude toward the needs of other threatened species and toward related environmental issues such as habitat destruction and water quality. Clearly, without that sympathy and the political will it engenders, the needs of more obscure species will go unmet. It may be trickle-down conservation, but in the light of the ever-increasing pressure on global resources, it may prove to be one of the more fruitful conservation strategies available in the years ahead."

SOME BALD EAGLE NICHE DIMENSIONS

NESTING Southern U.S. populations breed in the winter	MATING Pair for life; if one dies, the survivor will take a new mate	FOOD Live fish
NEST TREES Widely spread in forest; not close to others	YOUNG During first year after leaving nest, young are larger than parents	FOOD Live mammals
NESTS Often reused year after year (may reach 10ft across, weigh up to 4,000lbs.)	Requires a clean environment	FEEDING Large area with many fish
YOUNG After leaving nest, young remain with parents during first summer	NESTING A spring that is warm enough in April each year so that animals can nest	SUMMER Large bodies of open water or wetlands
Once common through much of North America	NEST TREES Strong limbs	NESTING Tall trees
Few natural enemies	YOUNG Remain in nest for 10 to 11 weeks	NESTING Form attachment to place where raised; tend to return when ready to breed
NESTING Both male and female help in building nest, incubating and caring for young	YOUNG Takes over three years before young look like parents	FOOD Live sea birds
NEST TREES Easy to get in and out from the air	Female is larger than the male	FOOD Carrion (dead animals)

STUDENT WORKSHEET: BALD EAGLE NICHE DIMENSIONS

WINTER Near large, ice-free bodies of water	FOOD Live water birds	NESTING Little or no human disturbance
NESTING Variety of trees	FOOD Water	NESTING Reluctant to nest right at the shoreline
NESTING Close to shorelines	NESTING Winter Roosts Protected from wind	
NESTING If eggs are destroyed will lay a second nest	NESTING Mature forest	

NICHE NOTES

Name _____

Organism _____

What does it eat? _____

What eats it? _____

What does it do? (Its profession)_____

_____

What effects does this organism have on other organisms in its community?

_____

_____

What effects do other organisms in its community have on this organism?

_____

_____

OBJECTIVES

After completing this exercise the student will be able to

1. recognize that humans are animals with adaptations that make us different from other animals;
2. identify two adaptations and tell how these adaptations help them in their habitat.

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 20 to 30

DURATION: 1 to 2 hours

SETTING: Classroom

MATERIALS: Chalkboard, markers, 15-20 adaptation cards, 3x5 index cards, watch, student actvity sheet "GAME CARDS"

Educator's Outline for

WIN, LOSE OR ADAPT

PROCEDURES: Copy and cut the Natural History Activity Sheet GAME CARDS, or use the following list with your class to prepare a set of 15 to 20 adaptation cards. They may be modified to meet your unit goals.

Insects

Antennae — used to feel, smell, and, in some insects, to hear

Compound eyes — often the biggest; many lenses

Mouthpart — female mosquito's is needle-like

Hard outer covering exoskeleton — protection from enemies; keeps from drying out, waterproof

Camouflage — moths, walking sticks; for protection

Biting jaws — ants; for working and carrying food

Stingers — bees, wasps; for protection

Eyespots — moths often have huge eyespots on their wings to scare off predators

Reptiles

Slimy skin — frogs; keeps skin moist and helps them breathe

Long, fast tongue — lizards use it to zap food

Forked tongue — snakes use it to "smell" their environment

Hard shell — turtles; protects body

"Fifth hand" — a chameleon can wrap its tail around a twig or branch for support

Birds

A. Beaks

Hooked beak — hawks, eagles; for tearing up food

Pouch-like beak — pelican; for carrying food

Long-hollow beak — hummingbird; reach nectar deep inside blossoms

Short, cone-shape beak — cardinals, sparrow; strong for opening seeds

Long thin beak — many shore birds such as curlew, godwits, snipes; to probe for food in mud

B. Feet

Feet for climbing — woodpecker; two toes in front and two in back

Feet for grasping — hawks and owls; large, curved claws, called talons, to dig into and hold prey

Feet for perching — robins, chickens; three toes forward, one long hind toe, sit on branches

Running feet — two toes on the ostrich; three on the killdeer; all pointed forward

Swimming feet — ducks; aid in swimming, walking on mud

Mammals

Paws with claws — most meat eaters; climb, dig for food or a home, hold their prey

Long pointed canines — most meat eaters; to stab and kill prey

Hooves — deer, antelope; for running

Teeth that never stop growing — mice, rats, squirrels, beavers, muskrat; teeth to last a lifetime of eating nuts, trees, snipping off stems /branches

Fur covered feet — rabbits and hares; good grip on slippery surfaces

Spine- or quill-covered bodies — porcupines; protection from predators

Horns — bighorn sheep, bison; permanent, slow-growing, for defense, mating fights

Antlers — deer, moose, elk, caribou; used for defense, mating fights, fast-growing

Whiskers — lions, wolves, coyotes; help animal to feel the environment when going through brush or small places, especially in the dark

Eyelashes — wolves, coyotes; keeps dust and other material out of eyes

Hair — all mammals (some have more than others to, keep heat in or cold out, protection — porcupine quills are hair

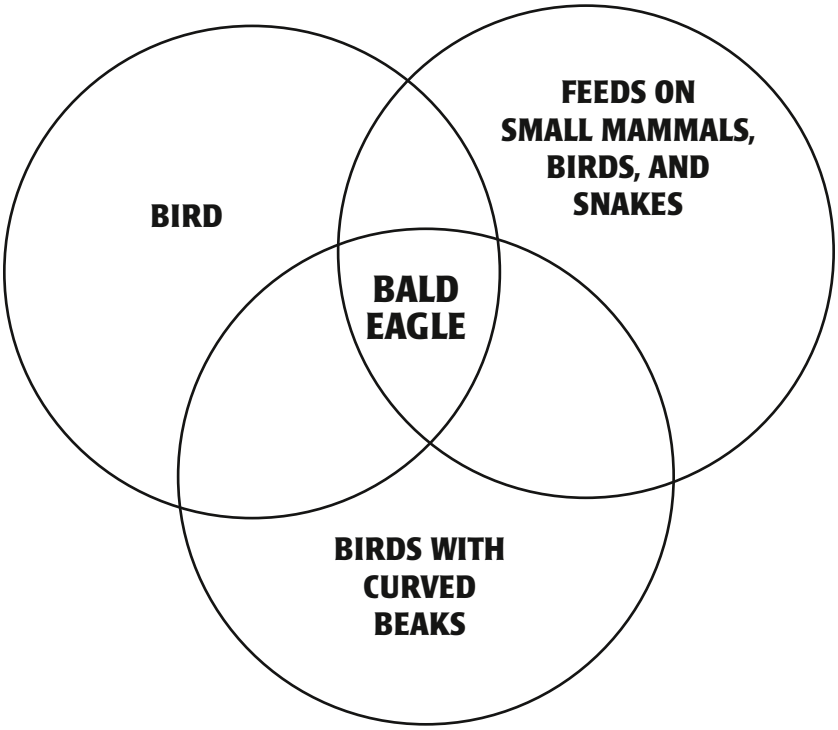
Ask students to suggest adaptations of humans and list them on the board. As students list them, ask them to describe the adaptation and how it is useful to humans. Some possible examples might include: upright posture (carrying objects, seeing distant objects, holding and throwing objects); eyes face forward (helps judge distance); movable neck; ear lobes (help gather sound); big brains (intelligence); thumbs (the specialty is an opposable thumb — it can touch the tips of the fingers, allowing very precise and delicate hand movements.); touch (fingers and hands are very sensitive); live in groups (cooperation, safety in numbers); speech (conversation, cooperation).

WIN, LOSE OR ADAPT

1. Describe three problems an animal you saw at the national park would have if it were suddenly transferred to the area of your school. Could these problems be solved? Why or why not?

2. Give three examples of animal adaptations. Which one is most similar to human adaptations? Explain your reasoning.

3. Write down everything you can about the bald eagle, based on the following diagram.



4. What are two things you can do to help prevent extinction of the earth's biodiversity?

GAME CARDS FOR WIN, LOSE OR ADAPT

COMPOUND EYES Often the biggest, with many lenses	STINGERS Bees, wasps, for protection	LONG POINTED CANINES Most meat eaters, to stab and kill prey
EXOSKELETON Hard outer covering, protection from enemies, keeps insect from drying out, waterproof	RUNNING FEET- Two on the ostrich and three on the killdeer, all toes point forward	SHORT, CONE-SHAPED BEAK Cardinals and sparrows, strong for opening seeds
EYESPOTS; Moths often have huge eyespots on their wings to scare off predators	FEET FOR GRASPING Hawks and owls, large curved claws, called talons, to dig into and hold prey	SWIMMING FEET Ducks, aids in swimming, walking on mud
LONG, FAST TONGUES Lizards use them to zap food	FORKED TONGUES Snakes use it to "smell" their environment	LONG, HOLLOW BEAK Hummingbirds, reach nectar deep inside blossoms
HARD SHELL Turtles, protects the body	POUCH-LIKE BEAK Pelican, carrying food	HORNS Bighorn sheep, bison, permanent, slow growing, used for defense, mating fights
HOOKED BEAK Raptors (hawks, eagles) for tearing up food	PAWS WITH CLAWS Most meat eaters, to climb, dig for food or a home, hold their prey	WHISKERS Lions, wolves, coyotes, helps feel surroundings when going through brush or small places, especially in the dark

OBJECTIVES

After completing this exercise the student will be able to

1. describe their impressions of the extinction of a species
2. identify the factors involved in the extinction of a species
3. have some feeling of "gone forever," that once a species has disappeared it does not reappear

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 20 to 30

DURATION: 1 to 2 hours

SETTING: Classroom

MATERIALS FOR CLASS: student activity sheet "MARTHA"

MATERIALS FOR STUDENT: Art and writing materials

Educator's Outline for

PASSING IN CINCINNATI, SEPTEMBER 1, 1914

PROCEDURE:

1. If you have a wooded area near the classroom where it is reasonably quiet and where there are nuts and berries, use it. You can give each student an acorn/berry — the food of the passenger pigeon — to hold during the story (Activity Sheet: MARTHA).

2. Students can sit or lie down. Begin the story of MARTHA. Ask students to relax quietly and sit or lie quietly and close their eyes. Ask them to imagine the sights and sounds of the story.

3. When you have completed the story, ask them to write their thoughts and feelings about Martha. They can use poetry or sentences. Be sure to give them enough time. Then ask them to draw or paint a picture to illustrate the story.

4. Discuss the pictures. Use these kinds of questions:

- How do you feel about losing this animal?
- Are you familiar with any other incidents of this kind?
- Is the extinction of the passenger pigeon a disgrace? No one says this about the extinction of the dinosaurs. Is anything different?
- What factors contributed to the extinction of the passenger pigeon? (e.g. hunting, habitat destruction)
- In 1857, a bill was introduced in Ohio to protect the passenger pigeon. A committee of the state legislature reported, "The passenger pigeon needs no protection.... no ordinary destruction can lessen them." Why do you think the committee made that decision?
- What lesson can we learn from the extinction of Martha?

- Do you think we have learned the lesson? What is your evidence?
- Can organisms become extinct today? How do you know?
- Have any organisms ever become extinct in the area where we live? How do you know? How could you find out?
- What do you think other people know about extinction? How could you find out?

MARTHA

Close your eyes.

Relax.

Get as comfortable as you can.

I am going to read you a story. As I read it, I want you to try to imagine the scenes and events.

When European explorers first came to America, they saw large flocks of birds known as passenger pigeons. There were millions and millions and millions of them. The passenger pigeon was a large and graceful bird. Including its long tapering tail, it was about 16 inches long. The head and back of the male were a glossy bluish gray. Underneath, the breast was red. The female was light brown above, and her breast was gray. They had sparkling red eyes. Some have described the eyes as "bright, fiery orange." They nested in northern forests in the summer and flew south in the fall. They usually laid only one egg on a flimsy platform of sticks and twigs someplace in a tree.

Usually more than a hundred other passenger pigeons nested in the same tree. Sometimes there were so many nests that limbs would break and fall to the ground. Passenger pigeons nested in large groups that covered large areas. A nesting area found in Michigan was 28 miles long and three to four miles wide. These were loud noisy birds. They sounded like a huge army of bullfrogs. Their droppings killed the plants underneath and stripped the trees of their leaves. In describing their nesting area, one person said it looked as though the forest had been struck by a tornado.

The food of the passenger pigeon consisted mainly of beechnuts, acorns, berries, and seeds. It was a fast flyer and could fly a mile a minute. It was known as the "blue meteor." Passenger pigeons flew in enormous flocks and could even block out the light of the noon-day sun, "their wings roaring like thunder."

They were also very tasty. Expert hunters killed large numbers. One hunter killed 1,200 a day over a week-long period. Upright nets were often used to capture them. Pigeons struck the nets with such force that they either fell dead to the ground or became entangled in the netting. Pigeon-netting was such a common practice that almost every town was equipped to net pigeons. At night, they could be quickly prodded from their roosts with long poles. They were so numerous that some people hunted them with sticks or stones.

Trappers caught thousands. These pigeons were kept in boxes and

released to be used as living targets for shooting practice. Grain was soaked in alcohol and used as bait. As pigeons lay helpless, fluttering on the ground, hunters could walk among the trees and fill their bags. Trees were cut down so that nestlings could be captured for market.

The shooting and hunting continued for years. When asked whether these birds needed any protection, officials would say no, there are millions of them. However, the United States was growing. There were more and more people. Railroad ties were beginning to crisscross the land. Forests were being cut down for timber and to clear the land for farming. The pigeons had to find new routes for migrations. Their food, acorns, beechnuts, and wild fruit became harder and harder to find. Gradually the flocks of pigeons became smaller and smaller. The flocks were scattered widely over the United States and Canada.

Finally protective laws were passed prohibiting the hunting of passenger pigeons. People thought they were safe, but each year fewer and fewer pigeons were seen. Their habit of producing only one egg at a time did not result in many offspring. On September 23, 1907, the last passenger pigeon in the wild was shot.

But there were still some kept in zoos. And there was hope that they would survive. However, even in zoos they didn't produce enough eggs. The older birds died faster than young birds hatched.

Eventually there was only one left. Her name was Martha, and she lived in the Cincinnati Zoo. Not much was known of Martha's past. She probably was born from a pair of captured pigeons in Wisconsin. She arrived at the Cincinnati Zoo in 1902. Her age is a mystery. No one knows for sure how old she was when she died. She might have, been 14 or as old as 29.

Martha is now mounted in a display case at the Smithsonian Institution in Washington, DC. The label on the museum reads: "Martha, last of her species, died at 1 p.m., 1 September 1914, age 29, in the Cincinnati Zoological Gardens."

When you are ready, open your eyes.

OBJECTIVES

After completing this exercise the student will be able to

1. describe the consequences of shrinking habitat
2. understand and describe the role of parks in preserving biodiversity
3. understand the role that all humans have to play in preserving biodiversity (letting Joe or Jane do it isn't enough)

GRADES: 5 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 1 to 2 hours

SETTING: Classroom

MATERIALS: 5 frisbees, 20 popsicle sticks, 25 name tags, rope/string

Educator's Outline for

THE INCREDIBLE SHRINKING HABITAT

Based on "Islands," The New Game Book, Doubleday and Company

THIS IS AN ON-SITE ACTIVITY

PROCEDURE:

1. Round One. Place the rope in a large circle and have students stand just outside of it. Tell them they can choose to be any plant or animal they would like to be. Have them make a nametag so that the others will know what plant or animal they are.

Place the frisbees inside the circle. Distribute 20 popsicle sticks among the five frisbees. Have Students walk or trot slowly around the perimeter of the rope circle. When you yell out "Home Address" students rush to get a popsicle stick. There is a rule: No pushing or shoving. Those who don't get a stick stand outside the circle.

2. Round Two and Round Three. Collect the popsicle sticks, reduce them by five, and redistribute them.

Do you have any ideas what the various rounds and frisbees represented? Round One = before Columbus and settlement of the U.S. by Europeans. Rounds Two and Three = Changes in habitat by Europeans, e.g., for agriculture, wood, cities. Frisbees = habitat. Diminishing number of frisbees = decreasing amount of habitat available for plants and animals. Elimination of species by bumping = interference by humans that decreases the amount of habitat available.

Organisms eliminated may be either endangered or have become extinct. The remaining frisbee(s) represent a national park. They provide habitat protection, and for many species provide critical habitat. Reinforce this concept and use a local example, if possible. Ask:

What are some ways humans "bump" into plants and animals and cause them to become endangered?

What are our views on what should be done about this?

Educator's Outline for

SCENERY SEEN

PROCEDURE:

1. During the interpretive walk through various habitats, stop and have students describe the habitat they are in. Take only a few moments and then gather students together to share what they have observed. Students have had a learning experience with the microhabitats of isopods. During the sharing and your discussion of the habitat, describe and point out microhabitats. Point out the examples in your park of critical habitat for endangered wildlife and plants. It may be something as "simple" as space; it may be a suite of specific requirements provided only by the park.

2. Use these kinds of questions:

   - What do we mean by habitat?
   - What are the characteristics of this habitat?
   - Have you ever seen this kind of habitat outside the park?
   - How is it similar to the habitat we just walked through? Different from that habitat?
   - What dangers do organisms face in this habitat?
   - How does this habitat meet the needs of organisms?
   - What is a descriptive name for this kind of habitat?
   - Could his habitat ever change? How? What are your ideas about what would happen then?

OBJECTIVES

After completing this exercise the student will be able to

1. describe the characteristics of particular habitat
2. compare differences between habitat
3. define critical habitat

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science
Language Arts Standard 3 – Listening and speaking

GROUP SIZE: 20 to 30

DURATION: 1 to 2 hours

SETTING: Classroom

OBJECTIVES

After completing this exercise the student will be able to

1. identify some of the biodiversity of a particular area (habitat/community/ ecosystem)
2. describe some differences between separate areas (habitats/ communities / ecosystems)

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Student activity sheet "HUNTING FOR BIOLOGICAL DIVERSITY." Optional: Flagging

Educator's Outline for

BIOLOGICAL DIVERSITY HUNT

PROCEDURE:

1. Make a copy of HUNTING FOR BIODIVERSITY and cut it into cards. Place them in a sturdy envelope. Make up your own cards that are relevant to your field trip.

2. Use a trail that goes through a variety of habitats/communities /ecosystems. Select two or three sites that are different and are easily supervised. Point out the boundaries of the area. You may want to use flagging to mark boundaries. Remind students that they should not collect or damage anything.

3. Divide the class into teams of three curious naturalists. Give each team two cards.

4. Give each team 10 minutes to find what their cards ask for. Have the teams take the class to the "finds." Collect the cards or have students exchange them for use on the next site.

5. Ask students these kinds of questions:
   - What are some words that describe the plants growing on this site? (This is a good time to remind students that all the plants and animals living together here make up a community. If it has a name, name it.)
   - What did you learn about animals on this site?
   - What are some ways we could learn more about the animals on this site?
   - How would you describe the biological diversity of this site? Rich or poor? What is your evidence?
   - Did anyone find a plant or evidence of an animal that no one else found?
   - Are some plants more abundant than other plants?
   - What would you say is the least abundant plant on the site?
   - How is this habitat/ community/ecosystem similar to the one we just studied? How is it different?
   - What are some words you would use to describe this place?
   - If appropriate, which team found evidence of species diversity? Individual variation?
   - Which of us is best dressed for hiding in this area? Break the class into small groups. Give them a minute to invent a game to test this.

HUNTING FOR BIOLOGICAL DIVERSITY

FIND THREE DIFFERENT-SIZED LEAVES FROM THE SAME PLANT	FIND AT LEAST THREE DIFFERENT KINDS OF HOLES MADE BY ANIMALS
FIND AT LEAST THREE DIFFERENT KINDS OF PLANTS GROWING UNDER A TREE	FIND THREE DIFFERENT SIGNS OF AN ANIMAL HAVING EATEN SOMETHNG
FIND AT LEAST THREE DIFFERENT ORGANISMS AND GIVE THEM DESCRIPTIVE NAMES	FIND AT LEAST THREE DIFFERENT KINDS OF LEAVES
FIND AT LEAST THREE DIFFERENT KINDS OF PLANT "SKINS"	FIND AT LEAST THREE LEAVES WITH DIFFERENT TEXTURES
FIND A PLANT THAT HAS THREE DIFFERENT COLORS	FIND AT LEAST THREE DIFFERENT PLANTS
FIND AT LEAST THREE DIFFERENT KINDS OF SEEDS	FIND THREE DIFFERENT KINDS OF CONSUMERS (ANIMALS OR EVIDENCE OF THEM)
FIND THREE DIFFERENT SPIDERWEBS	FIND THREE DIFFERENT KINDS OF DECOMPOSERS
FIND AT LEAST THREE DIFFERENT KINDS OF LEAF STALKS	FIND AT LEAST THREE PLANTS WITH DIFFERENT ODORS
FIND THREE DIFFERENT LICHENS	FIND BIODIVERSITY IN AT LEAST THREE DIFFERENT SHAPES: SQUARE, TRIANGLE, OVAL, HEART, RECTANGLE
FIND THREE DIFFERENT FLOWERS	FIND AT LEAST THREE DIFFERENT INSECTS

OBJECTIVES

After completing this exercise the student will be able to

1. investigate biodiversity at many levels
2. make comparisons
3. make observations about numerical and spatial aspects of biodiversity
4. become a sharper observer of their outdoor surroundings

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science
Language Arts Standard 2 – Writing
Language Arts Standard 4 – Viewing and presenting

GROUP SIZE: 25

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Rings or yarn, hole punch, and student activity sheet "BIOLOGICAL DIVERSITY."

Educator's Outline for

SCAVENGE FOR BIOLOGICAL DIVERSITY

PROCEDURE:

1. Copy the BIOLOGICAL DIVERSITY CARDS (onto heavy paper if possible) and cut them up to cards. Punch a hole in the upper left-hand corner of each card and place them on a ring or thread yarn through them. Group them into categories, or into small bunches if you want.

2. Place students in groups of four or five. Give each group five to ten minutes to develop a way to express biodiversity. It may be a dance or a play or a reading. Afterwards, ask questions like:

- What are some reasons that there is less biodiversity in human communities than in natural communities?
- How is human diversity similar to biodiversity? How is it different?
- What is the chief characteristic of a place that has more biodiversity than another place?
- What things does your community have in common with the park community? In what ways do the two communities differ?
- What question has been raised by our study of biological diversity?
- You may have heard someone say, "Variety is the spice of life." What does this have to do with the biodiversity of plants and wildlife?

3. Use the cards to investigate the biodiversity of your schoolyard or immediate neighborhood. How many can your class complete in a day or a week or a month? If you take students camping, use the cards.

4. There are a variety of ways these experiences can be summarized. Students can write descriptions; write poems/haiku; contribute their observations to a class book or chart on biological diversity; or make an illustrated report or make a large group/class mural. You might ask the class to develop a list of words that describes the different plants and animals they found and studied. Then use the same cards in a different place — another community. Develop another descriptive list of words, then ask students: What does this community we just studied have in common with the community we studied two days ago? In what ways do the two communities differ?

SCAVENGE FOR BIOLOGICAL DIVERSITY CARDS

Find something in nature ready to burst.	Find a rock with things living on it.	Find as many animal homes as you can.
Find a smooth bud. A sticky one.	Find 10 fruits, (must be the same kind), each one different in some way.	Find a plant or animal in the shape of a triangle. A circle. An oval. A square.
Turn over a rock. How many different living things can you find?	Find an animal with more than six legs.	Listen to the woods. What sounds do you hear?
Find an animal with no legs.	Place an obstacle in the way of an animal. What does it do?	Make a mask of your favorite wild plant or animal outdoors.
Find a plant that is smooth. Rough. Prickly.	Name three benefits of biodiversity 1. 2. 3.	Find the five most common plants in two different communities. How are they alike? How are they different?
Find an evergreen your age. How are You alike? How are you different.	Find the opposite of a biodiverse place.	Be an animal detective. Find evidence that animals have been in a particular spot.
Find a biodiverse place.	Find an animal with six legs.	Find three different kinds of buds (with different colors, shape, size, scales, shininess, wooliness, etc.)

SCAVENGE FOR BIOLOGICAL DIVERSITY CARDS

Find the five most common plants in two different communities. How are they alike? How are they different?	Find the three most common plants on the ground in the woods. In a field. In a wet place. In your schoolyard.	Find animals living in the soil.
Find animals living on shrubs. Place paper or plastic on the ground and brush or shake the shrub with a stick.	Find animals living in leaf litter.	Find three different ways that plants climb.
Find three different kinds of buds (with different colors, shape, size, scales, shininess, wooliness, etc.)	Find three different animals. What words describe their shape?	Find the largest and the smallest leaves from a lawn. A tree. A shrub.
Find animals living on shrubs. Place paper or plastic on the ground and brush or shake the shrub with a stick.	What words describe the texture of two different trees, an earthworm, two different shrubs, a snail, a grass blade.	Find three different shrubs with different colored stems.
Be an animal detective. Find evidence that animals have been in a particular spot.	Look under a tree. Find all the different parts that have been shed by the tree that you can.	In the fall, find a spiderweb. Examine the remains of their captives.
Find two different trees about your height. How do the branches grow from the trunk?	In an old field community, find all the dead plant parts you can..	Find a plant and describe its habitat.
Find plants of the same kind growing in a shady spot and a sunny spot. How are they alike? How are they different?	Find six plants with protective parts (a sting or thorns). Be careful!	Make a temperature map of a biologically diverse area.

SCAVENGE FOR BIOLOGICAL DIVERSITY CARDS

Make a moisture map of a biologically diverse area.	Make a sunshine/shade map of an area that is not biologically diverse.	Find an animal predator.
Make a sunshine/shade map of a biodiverse area.	Find a plant predator.	Find a human-like face in nature.
Find out how an organism reacts to another organism.	Put your pencil point on a sheet of paper. Trace the fall of three different leaves.	Find a common plant.
Find a place where there is a plant in front of, to the left of, to the right of, and behind you.	Find a change made by humans that increased biodiversity.	Draw pictures of the life cycle of a tree.
Find a change made by humans that decreased biodiversity.	Find a change made by human that has changed biodiversity.	How many of these live in your area? ☐ animals ☐ shrubs ☐ trees ☐ spiders ☐ insects ☐ ferns ☐ mushrooms
Make a temperature map of an area that is not biologically diverse.	Observe and record a changed an organism.	Collect wild seeds. Describe them. Label their parts.
Make a moisture map of an area that is not biologically diverse.	Find out how an organism changes its environment.	Find biological diversity in a jar of water.

SCAVENGE FOR BIOLOGICAL DIVERSITY CARDS

Find two flowers that look the same but smell different.	Find a decomposer.	Find an animal home.
Name some populations in your community.	Describe two differences between a young organism and an old organism.	Watch a plant for at least ten minutes. Record the amount of time and kinds of insects that visit it.
Find evidence of the presence of earthworms. Of ants.	Find evidence of the presence of a large animal.	Find a leaf whose veins start from a central vein.
Find evidence of a plant's response to a non-living factor.	Find evidence of a plant's response to a living factor.	Find a leaf that feels hairy.
Find evidence of a plant's response to an environmental factor.	Find something living in a wild place that is also living in your community.	Find a plant whose leaves grow right next to die ground.
From where you are standing, how many different plants can you see?	Find a seed that travels by wind.	Find a leaf with holes in it.
Find a place in your community where biodiversity is threatened.	Find a leaf with parallel veins.	Find a leaf with veins that start from a central point.

SCAVENGE FOR BIOLOGICAL DIVERSITY CARDS

Find a smooth leaf.	Find a leaf with bumps.	Find a leaf whose edge (margin) is smooth. Wavy. Saw-tooth. Lobed.
Find a seed that travels by sticking to things.	Find a shrub or tree with teeth marks on the stem.	Find at least three different ways evergreen tree needles attach to branches.

OBJECTIVES

After completing this exercise the student will be able to

1. describe the effects of habitat loss of migrating birds in another part of the world.

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Lengths of rope, each one long enough to comfortably encircle the class, tent pegs. Optional: hammer.

Educator's Outline for

GOING AWAY FOR WINTER – OR, WHAT DO WE MEAN BY "OUR?"

BACKGROUND: Protecting nesting areas may be only half the job for birds that winter in Central and South America. Wisconsin, for example, had a "watch list" of 32 bird species experiencing population decline or some other problem. Seven of these species must migrate to Central and South American rainforests for the winter, and seven others migrate to other parts of South America. In Wisconsin, many of what are referred to as "our" birds depend on jungles for their winter range. These include Eastern wood pewees, veerys, parula warblers, and Canada warblers.

PROCEDURE:

1. Select a large playing area about 50 to 75 feet in length. Make a circle from each length of rope at either end of the playing area. Each circle should have one end of the rope attached to a tent peg. One circle represents the summer home range, while the other represents the winter home range.

2. These are the rules of the game. The "birds" start in the summer range, in which they may freely "fly" about and make bird sounds. You call out months; when you call out the migrating month (pick one appropriate to your area), the "birds" must fly to the winter range. At the winter range, when you call out the migrating month (pick one), the birds must fly to their summer range.

After each round of migration, make the winter range smaller. Students must be inside the winter range to survive; they must be able to range around freely and comfortably. Those that bump into one another or step on the rope are out, and can stand at the sideline. Emphasize that there is no pushing or shoving. Summer range is also declining but at a much slower rate than winter range. You may want to include this change in the game.

3. You can carry the cycle of migration to its bitter end or stop at an appropriate point. Emphasize that many, perhaps all, of these birds are not endangered or threatened with extinction — yet. They are undergoing a population

decline. Winter habitat for migrating birds is declining rapidly. (Each year, an area about the size of Pennsylvania disappears from tropical rainforests.)

4. In discussion, ask these kinds of questions:

   - What is the difference between this kind of change and an outbreak of a forest disease in an area of a tropical forest? (Emphasize short- and long-term effects.)
   - Sometimes we refer to these birds as "ours." Whose are they?
   - Is habitat loss pollution? Describe similarities and differences.
   - These birds spend part of their lives in parts of the world that are not as developed as ours. People living there want a better way of life, and one way they see to do this is by logging forests and clearing for agriculture. Can you think of any arguments that might be used to help them reconsider the destruction of tropical rainforests?
   - Why might people in these countries resist some of our arguments on beauty or it's nice to have birds around? (Emphasize economic arguments on how plants and animals can "earn" money by promoting tourism, and providing medicines and foods.)

EXTRA CREDIT: Each second, we lose an area of rainforest the size of four-fifths of a FOOTBALL FIELD, or 54 acres cleared per minute. Have kids form a rectangle 80 yards long and 50 yards wide, and imagine that area is a rainforest in the tropics. It will help if you have the area premarked at each of the corners. Tell them by the time they count 1,001, this area, once a forested tropical rainforest, has been cleared. It's gone, more than likely forever. It may be gone for agricultural land or timber or city development or a highway. The area may have been winter habitat for some of our familiar birds, if so, they have been eliminated. There is not another place for them to move to or other food for them to eat.

To represent the difference in area between 1 and 2 seconds, have kids increase the area. One end of the line should move 80 yards in one direction, then count 1001, 1002, the tick of the habitat destruction clock. In a minute the area is equal to 10 CITY BLOCKS … GOING … GOING … GONE!

OBJECTIVES

After completing this exercise the student will be able to

1. describe plants and animals of special interest in the park.

GRADES: 6 TO 8

AZ CURRICULUM STANDARDS:
Science Standard 4 – Life science

GROUP SIZE: 25

DURATION: 2 hours

SETTING: Outdoors

MATERIALS: Masking tape and pen

Educator's Outline for

WHAT EXTINCT OR ENDANGERED SPECIES AM I?

PROCEDURE :

OPTION 1. Write the name of an extinct or endangered plant or wildlife species on masking tape. Stick it to a student's back. National Park examples should be used. Indicate whether it is extinct or endangered. The student should not be able to see what species s/he is. The student then asks five to ten other students questions that can be answered only with a yes or no. Several students may use the same species.

2. After students have asked their questions, have the students form a semi-circle so that all can see, and stand one of them (or all who are the same species) with his or her back to the circle. S/he should tell the group as many things as s/he can about the species, including which one s/he thinks it is. If the student is unsuccessful, have the class help by describing its characteristics.

3. When students learn the identity of their species, take some time to add interesting information about the species. Also discuss the lesson:

   - When we say an organism is extinct, what are its chief characteristics?
   - Can you define endangered/extinct?
   - What if someone were to suggest that eventually all animals and plants will become extinct?
   - S/he asks "What's all the fuss about an endangered species?" What would you say? What is another way of looking at this? Who has another view?

OPTION 2. During a trail walk, tie the theme of extinction/endangered plants or endangered wildlife to the topic of biodiversity, which you are pointing out and discussing biodiversity. From time to time, tape the name of an endangered or extinct species on the back of a student. Have the student ask questions of her or his classmates that can be answered only with a yes or no answer. If the park trail passes through habitat that is similar to habitat requirements of the extinct/endangered species, ask students to describe and name the habitat. Use this time to discuss such issues as species protection, reintroduction plans, and problems.