

Information for Teachers and Suggested Activities



The purpose of the attached material is to introduce you and your students to Tohono Chul Park's Outreach program — *Endangered Species: Saving the Ark*. The materials are offered as preparation for our presentation, and as ideas for additional activities in your classroom. These are suggestions only, but we hope that you will incorporate them into a unit on bats, mammals in general, or animals of the Sonoran Desert. If you

have any questions, please give us a call at 742-6455 x 228.

Outreach Programs and the Arizona Standards

Depending on the grade level of your class, this docent-conducted Outreach program will cover some or all of the following Arizona Standards:

Arizona Science Standards

Standard 1: Science as Inquiry

- o 1SC-R2. Ask questions about the natural world
- o 1SC-R6. Communicate observations and comparisons through various means
- o 1SC-F4. Describe relationships among parts of a familiar system

Standard 3: Personal and Social Perspectives in Science and Technology

- o 3SC-F3. Describe and explain the interrelationship of populations, resources and environments
- o 3SC-P4. Identify and describe the basic processes of the natural ecosystems and how these processes affect, and are affected by, humans
- o 3SC-P5. Describe and explain factors that affect population size and growth (e.g., quality of environment)

Standard 4: Life Science

- o 4SC-R1. Distinguish living from non-living things
- o 4SC-R2. Describe the basic needs of living organisms
- o 4SC-R3. Recognize and distinguish similarities and differences in diverse species
- o 4SC-F1. Describe and explain cause-and-effect relationships in living systems
- o 4SC-F2. Trace the life cycles of various organisms
- o 4SC-F3. Identify the basic structures and functions of plants and animals
- o 4SC-F4. Identify characteristics of plants and animals (including extinct organisms) that allow them to live in specific environments
- o 4SC-F7. Explain the interaction of living and non-living components within ecosystems
- o 4SC-E1. Construct classification systems based on the structure of organisms
- o 4SC-E7. Explain and model the interaction and interdependence of living and non-living components within ecosystems, including the adaptation of plants and animals to their environment

ENDANGERED SPECIES: SAVING THE ARK

The last word in ignorance is the man who says of an animal or plant: "What good is it?" If the land mechanisms as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

— Aldo Leopold, The Sand County Almanac

The extinction of species has occurred since life began. It is a normal and natural process. The current extinction rate is not. The environment today is changing so quickly that many species do not have time to adapt. As human populations grow, development encroaches on wildlife habitat and species extinction increases. Though habitat destruction is the principal problem, pollution, poaching, introduction of non-native species and illegal trade also place many species at risk. Since the first landings at Plymouth Rock in 1620, more than 500 North American species have become extinct – this at a rate of more than one per year. Natural processes would normally account for the loss of one species every 100 years! In the 1970s, the extinction rate was one species per day. According to the World Wildlife Fund, by 2025 we could lose as many as one-fifth of all species known today. The IUCN – World Conservation Union estimates 34,000 species of plants and 8,700 species of trees worldwide are in danger of extinction. We must recognize that a variety of animal and plant species are of aesthetic, ecological, educational, historical, recreational, and scientific value to mankind. We have an obligation to protect them. Through education, understanding and compromise, we can work together to protect this legacy for future generations.

*We have not inherited the Earth from our parents,
we have borrowed it from our children.*

— International Union for the Conservation of Nature/World Conservation Strategy

HABITAT

Every living species has certain requirements for survival. Some of these may be specific to that species alone in the entire world. Where an area corresponds to these needs, the animal will usually be found. Where conditions vary, sometimes by even the slightest degree, it will not. Habitat is more than “place” and more than animals and plants - includes water, soil, and the relationships between its living and the non-living elements. Animals and plants can change their habitat and make it unsuitable for other species, or improve living conditions for all.

Habitat varies from species to species, but includes all of the needs of that species. It is the total environment upon which that species depends. Every habitat consists of separate elements - the watering hole for javelina, the cholla for nesting cactus wrens, the saguaro fruit for the white wing dove - but all of these together are necessary for the survival of the species.

What are the components of habitat? **Food** and **water** are high on the list of essentials, though the two words can mean very different things for different species. Food for many

animals changes with the seasons — water to a Desert Pupfish means something different than water to a coyote (quantity and quality are also factors). **Shelter** is also a requirement. Another element is **space**. Animals, and humans, are territorial to one degree or another. There must be areas in which an animal feels secure from intrusion by others of his own kind and in which there are enough of the first three elements to satisfy his needs. Finally, the **arrangement** of these components in relation to one another is just as important. This simply means that the available food, water, shelter and space must be properly distanced from each other within the animal's recognized space. When food is too far from water and shelter is not close enough to either, or escape cover is too distant from all, then the habitat is not suitable for that species.


Another habitat term to be familiar with is **carrying capacity**. This refers to the ability of a particular habitat to support a given number of the kind of plants and animals found in that area. The carrying capacity of a particular habitat will change with the seasons. Other factors will influence capacity - climatic changes, pollution, and habitat destruction.

Microhabitats are small areas within a larger environment that have a significantly different climate. For example, some microhabitats around a home include hot, south- and west-facing walls, cooler north walls, and the shade areas under trees. Each of these locations has a climate that is modified from that of the surrounding area. Plants will do well in one of these microhabitats, but not in another.

Perhaps the most important threat to wildlife species today is **habitat fragmentation**. Whenever human activity, like highways or housing developments, creates obstacles to the natural movement of animal populations, the chances for local, as well as global, extinction increase. Species cannot safely move from areas of low carrying capacity to areas where there is room for population expansion. In addition, isolated populations can suffer from the loss of the periodic influx of new genetic material — witness the decline and predicted eventual extinction of the desert big horn of the Santa Catalina Mountains.

In order to mitigate the potential destructive outcome of increased human development of formerly open spaces, there is a movement to preserve **wildlife corridors** as well as expanses of undisturbed habitat. Wildlife corridors are natural areas that serve as passage-ways for a variety of species to travel from one habitat to another. It is no longer enough to protect a particular environment for wildlife and then deny that wildlife the ability to come and go at will. The big picture has to include protected areas of wilderness made contiguous by linking wildlife corridors.





Home For Sale

Have your class write classified ads for their favorite animals' habitats. You or your students can select the animals, then let the class research their natural history, discovering the following information:

- Where does the animal live?
- What kind of habitat does it live in?
- Does it build a special type of home?
- What does it eat? What tries to eat it?
- What else does it need in its habitat?
- Is its habitat in danger? What threatens it?
- What can be done to protect it?

Once the research is done, write the ads and post them around the room. Which ones are likely to be filled quickly?

RIPARIAN HABITATS

As defined by the Arizona Legislature, a riparian area is “a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depend on having roots in the water table or its capillary zone and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond or marsh bed maintained primarily by natural water sources.”

Arizona’s riparian communities are diverse associations of plants and animals that live on the banks of the state’s rivers and streams. Biologists estimate that 75% of Arizona’s wildlife species depend on these habitats for at least part of their life — from visiting migrating birds who find respite in the shade and food in the abundant insect populations, to resident amphibians and fish who could not survive this dry desert without these oases. These riparian areas are essential to the survival of a number of endangered or threatened species. The United States Fish and Wildlife Service estimates that two-thirds of the Federally listed species in Arizona and New Mexico are dependent to a significant degree on these riparian habitats. However, less than 0.5% of Arizona is riparian habitat, and over 90% of that habitat has been altered or destroyed.

Not long ago the word **riparian** (from the Latin *ripa* meaning bank or shore) was familiar only to biologists and naturalists. This has changed in recent years as research has revealed the extraordinary importance of southwestern riparian communities to native wildlife. Today the word is seen and heard regularly in the news media as we wrestle with the problems of preserving these precious and dwindling natural areas.

Studies of nesting birds were first to suggest the critical importance of riparian communities to southwestern wildlife. Ecologists now estimate that roughly half of all breeding birds in the

lowlands (deserts and grasslands) of the Southwest nest exclusively in riparian habitats. About another quarter of the region's breeding birds seem to nest preferentially in these communities. Similar statistics are emerging from research into riparian amphibians, reptiles and mammals. Numbers like these are all the more astonishing, considering that riparian communities cover much less than one percent of the total land area!

There are many reasons for the remarkable diversity of wildlife in southwestern riparian habitats. It is to be expected that in an arid land the presence of aboveground drinking water is a magnet for many animals. However, the abundance of water beneath the ground near a desert stream may be even more important, since it results in a greater concentration of wildlife food in the form of vegetation and plant-eating insects. Tall trees such as sycamores, smaller trees such as mesquites, fallen tree limbs, shrubs, grasses, and herbs provide a great variety breeding, feeding and escape situations, accommodating a diversity of animal lifestyles or niches. Riparian communities also provide convenient corridors for the movement of wildlife through less favorable habitats. Floods are also a necessary part of these riparian forests. Periodic flooding deposits silt and fertile sediment, cleaning out shrubs and saplings from riverbanks. Cottonwoods and willows will not sprout under their own canopies nor compete with other grasses or annuals. For spring germination they require the bare, moist, sandy areas, the exact conditions left by late winter floods.

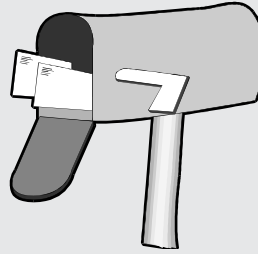
The scarcity of water in arid regions has put mankind in competition with riparian plants and animals for thousands of years. The earliest civilizations in the arid Old World were centered on rivers: the Nile, Tigris and Euphrates. Here in Arizona, the prehistoric Hohokam Indians also exploited the waters of desert rivers for irrigation. When the Spanish arrived in the Tucson area over 300 years ago, they found Piman Indians, probable descendants of the Hohokam, living in farming villages along the Santa Cruz, parts of which flowed above ground year-round. About a century ago floods, due perhaps to over-grazing and a changing climate, caused the Santa Cruz and its tributaries in the Tucson basin to cut downward, lowering the water table. Since then groundwater pumping has dropped the water table still farther. Today Tucson's rivers flow only sporadically. The result has been the destruction of most of the original riparian vegetation in Tucson, and the loss of most of its diverse animal life.

Urbanization, dams, over-grazing by cattle, floodplain farming, excessive woodcutting, and a changing climate have all contributed to the degradation and loss of riparian communities throughout Arizona. Today no more than 10% of Arizona's riparian communities exist in anything resembling their original conditions. Those that remain are among the most precious resources in Arizona's natural heritage.



Habitat Pen Pals – with thanks to PLT

Students can learn about the diversity of habitats around the world and write letters from the perspective of plants and animals living in these habitats.



Step One

Collect pictures from magazines that represent each of the following habitats:

tundra	ocean
desert	saltwater marsh
prairie	deciduous forest
African savanna	pond or river
tropical rainforest	

Also look for pictures of some of the animals that live in these habitats, such as jackrabbits and coyotes in the desert and whales and sharks in the ocean.

Step Two

After discussing what a habitat is and what things an animal needs to survive in its habitat (you might start with some local habitats like the schoolyard or the neighborhood park), describe the habitats listed above. Ask students where in the world these habitats might be found and what animals might be found living there. You can post the pictures of the habitats around the room and ask students to post the animal pictures under the appropriate habitat. Discuss the variety of species found in any one particular habitat and point out that “deserts” are not exactly the same the world over.

Step Three

Have each student select a habitat to research. Afterwards, assign each student a “pen pal” from another habitat without revealing who that student is. Explain that each one is to choose an animal from their habitat and write their letters from this animal’s point of view. Keep their identities a secret!

Step Four

To help students get started, provide suggestions for questions to ask and answer in their letters: What is the climate like? Name other animals that live in your habitat? Describe the plant life. Describe geological features. What do you eat? The more information they can include, the better. They can also practice their writing skills, being creative in painting a picture of life in another environment.

Step Five

Once the letters are completed, have students address them to their pen pals and set up a postmaster to make the deliveries. Have students guess which habitat and animal their pen pal represents and then share the letters with the class. Try this exercise again with plant species.

WEB OF LIFE

A **food chain** illustrates the connections between plants and animals. In simple terms, who eats whom to survive? Life in nature is about transferring energy/food and a food chain shows how the transfer of energy between species works.

The sun is the source of energy for most living things. Plants are producers that capture energy from the sun through a process called photosynthesis (the energy of the sun is used to convert carbon dioxide and water into sugars, with oxygen given off as a by-product). Animals that gain energy from plants are **primary consumers** (herbivores). **Secondary consumers** are predators (carnivores) that eat the primary consumers. At the highest level of the food chain are the top predators. Top predators can feed on any of the levels below and are seldom prey themselves.

The following is a simplified example of how a food chain works. A saguaro is a producer, providing nectar, pollen and fruit for many species. Primary consumers of the saguaro include be insects, bats, and birds. These animals partake of the cactus' bounty and in turn pollinate the saguaro's flowers and disperse its seeds. Secondary consumers are those that eat the insects, such as birds, or eat the birds and bats, such as an owl. The owl itself would be considered a top predator as it has few natural enemies.

If a particular plant that supports a food chain is destroyed, then the species that depend on that plant could soon follow. Scientists estimate that the extinction of one plant species may effect up to 30 other species of plants and animals.

When food chains intertwine with one another a **food web** is created. A food web represents interconnected chains of producers and consumers. The owl or the bobcat can eat the bat that pollinates the saguaro. They may also eat the grasshopper mouse, which in turn ate the insect that also visited the saguaro flower.

Food chains and webs are good examples of why each species is important and how each depends on others for survival. This interconnectedness is known as the web of life. Species' extinction weakens the web of life but it also weakens our planet's biodiversity.

Food Web

A very visual way to explain how a food chain turns into a complex "web of life." All you will need are a ball of yarn and a set of desert "Food Web" cards. Make copies of the blank ones on pp. 32-36 and have students add their own pictures.

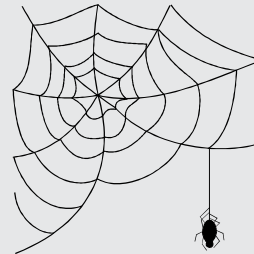
Step One

Distribute cards to each student. You can try the exercise with the entire class, or break them up in to smaller groups. The person with the sun card starts by holding one end of the ball of yarn. In order to pass the ball to another classmate, he/she has to state the connection between the sun and the next element – for

example “the sun gives energy to grass.” The grass then passes the yarn to another student, also explaining the connection – “the grass provides seeds for the kangaroo rate.” Each time the yarn ball is passed, the student holds onto his end so that a web is formed. Keep the tension on the string tight and make sure the yarn ball gets passed to everyone.

Step Two

Once everyone has a hold on the web, designate one individual and announce that his/her species has died due to pesticide poisoning or deliberate act. That student drops the string and it begins to go slack all around the web. Each student who feels the slack in his/her yarn, lets go. Soon the entire web has collapsed all because of the loss of one species.



BIODIVERSITY

If species can prove their worth through their contributions to agriculture, technology and other down-to-earth activities, they can stake a strong claim to survival space in a crowded world.

— Norman Myers, *The Sinking Ark*

Since life began on planet Earth, a myriad of lifeforms have come and gone, extinguished by natural events such as changing physical and biological conditions. Extinction may be part of the natural order, but we can no longer attribute the accelerated decline in species to natural processes. Today, the demise of particular species is ultimately tied to habitat loss and degradation, environmental pollution, introduction of exotic species or exploitation of natural resources. The loss of a single species can set off a chain reaction that affects many others. One plant can take with it up to 30 other species - insects, animals and other plants. The long-term effects of a single extinction, or the introduction of a single exotic, may not always be readily apparent.

Biotic diversity, shortened to **biodiversity**, has been defined as “the variety of life and its processes.” It refers to the tens of millions of distinct species of plants, animals and microorganisms that share the Earth. These species, in various combinations, form living communities that physically interact with their particular habitats, the lifeforms and their environments together forming **ecosystems**. These ecosystems contain both living and non-living (abiotic) components, for environments include climate, water, and soil as part of each ecosystem. The interaction of the living and the non-living components results in biological diversity. Think of your schoolyard or backyard and about how many plants and animals live there — insects, lizards, birds, and trees, cactus, and flowers — a variety of life in the desert. If there were only one type of environment, such as the desert, there would be only desert plants and animals. But there are many kinds of environments, such as grasslands, forests, rainforests, wetlands and the planet’s oceans, lakes and rivers.

Habitat degradation results in the loss of distinct populations of lifeforms and therefore parts of ecosystems. Over time, these accumulated fragmentary losses can add up to the permanent disappearance of entire species and communities. The plow transformed the prairie into the “breadbasket” of America, but in the process, significantly reduced the biodiversity of the plains.

Reasons for preserving biodiversity range from the aesthetic and ethical to the economic and scientific. But the most alarming consequence of the destruction of such diversity is in the loss of “ecosystem services,” according to leading environmentalist Paul Ehrlich. Every organism is a functional part of an ecosystem. All ecosystems are woven together by flows of energy and cycles of materials, all of which can be thought of as the life-support apparatus of the planet. When a species becomes endangered, it is a warning that an entire ecosystem may be in trouble. The loss of one species may lead to the loss of others, degrading the same habitat that humans depend on for the maintenance of the quality of the air we breathe, the regulation of the earth’s climate, and the provision of a fresh water supply. Other ecosystem services provide for the recycling of dead and decaying matter into new and fertile soils, the pollination of crops, and the control of pests.

An all-encompassing theory for the interrelationships of lifeforms is the *Gaia Hypothesis*. Developed by Dr. James Lovelock over the past 30 years, the theory proposes that the planet is alive and that it functions as a superorganism in which living things interact with geophysical and chemical processes to maintain the conditions needed for life - as we know it. Scientists have yet to determine the exact mechanisms by which life processes regulate such things as the earth’s climate and atmosphere, but this only makes it more imperative that habitat destruction and mass extinctions are halted since we do not know which species may be essential for our own survival. In other words, Lovelock believes that it is the Earth’s ecosystem as a whole that matters and not the future of any individual species. All living things from bacteria to blue whales play a role in maintaining the health of us all.

Biological Diversity Hunt – with thanks to the National Park Service
This activity will help students to identify some of the biodiversity to be found in a particular habitat and describe the differences between several habitats.

Step One

Copy the “Hunting for Diversity” cards (pp.37-38) onto cardstock and cut the cards apart, placing them in a large envelope. You can add additional cards specific to the site you choose for the activity, if you like.

Step Two

Find an outdoor habitat that hosts diverse wild-life and plant life. Try your schoolyard, or plan a visit to a local nature center, zoo or botanical garden. Select a trail that passes through the site or two or three areas that are differ-



ent. Point out the boundaries of the area to the students. Remind students that they are not to collect or damage anything.

Step Three

Divide your class into teams of three. These are your naturalists. Give each team two cards and ten minutes in which to find the items asked for. Have each team show the class what they have found. Collect the cards or have the students exchange them for another round.

Step Four

Ask your students the following kinds of questions:

What are some of the words that describe the plants growing on this site?

What did you learn about animals at this site?

How would you describe the biological diversity of this site? What is your evidence?

Did anyone find a plant or evidence of an animal that no one else did?

Are some plants more abundant than others at this site? Which ones? Why?

How is this habitat similar (dissimilar) to others we have studied?

How would you describe this site?

WHY SAVE SPECIES?

*Man depends on wildlife for survival, and wildlife depends equally on man.
The two must find the means for living together on planet earth
or there will be no life on earth.*

— Raymond R. Dasmann, *Wildlife and Ecosystems in Wildlife and American*

Sometimes it may be hard to see the value of any one species. For example, if we had lost the rosy periwinkle (Madagascar), we would have lost a valuable tool in the fight against cancer. The periwinkle contains in its leaves, an anti-cancer agent that is used to treat childhood leukemia and Hodgkin's disease. Forty percent of all modern medicines are either modeled on or synthesized from natural compounds derived from plant or animal species. Yet, 95% of known plant species have yet to be tested for their medicinal uses, and 68% of the 250,000 species of the world's flowering plants are found in tropical rainforests which are being destroyed at an estimated rate of 41.7 million acres per year. One out of every ten plants in the United States is in danger of extinction.

In the 1970s, genetic material from a species of wild corn was used to stop a leaf fungus that had destroyed 15% of the United States corn crop. Of the estimated 80,000 edible plants in the world, we depend on only 20 species to provide 90% of the world's food supply. Just three – rice, corn and wheat – provide more than half of those resources. Scientists have used the genetic reservoir of some of the wild relatives of these crops to provide pest and disease resistant strains. Wild plants can also provide the means to develop crops able to withstand

harsh growing conditions, thereby increasing production in marginal growing areas. In addition, much of the food we eat is made possible as a direct result of pollination efforts of “wild” bees and other “forgotten” pollinators.

We also harvest wild species directly for food – fish and shellfish taken from our rivers, lakes and oceans – yet many populations have declined due to habitat degradation/destruction or pollution and restrictions have been placed on their collection.

Healthy species populations also contribute to the healthy ecosystems that we depend on to provide healthy environments for humans as well as plants and animals. Endangered species are an early warning that all might not be right with an ecosystem that provides us with clean air and water. The loss of the northern spotted owl may have affected the logging industry, but it was also an indication of the declining health of the old growth forests of the Pacific Northwest due to decades of unsustainable forest management practices. Pollution is killing the coral reefs along the Florida Keys, putting hundreds of species of fish at risk, as well as a multimillion dollar tourism industry — for in addition to their usefulness in providing food or medicine, plants and animals are an important source of recreation and aesthetic pleasure. Each year over 108 million people participate in wildlife recreation, from legal hunting to photographing wildlife.

During the 1st half of the century, the extinction rate was about one species per year. By the 1970's, researchers had estimated that our world was losing about one species every day. Some experts say that in the year 2000, the extinction rate will be 110 per day.

These accelerated rates of extinction are a result of two human factors: increasing human population and the treatment of the global environment. Most of the harm we do to other species results from the loss of habitat. In the continental United States, over 50% of our wetlands have been destroyed and only 10% of old growth forests remain. Clearing land for farming, urban sprawl, mining, timber harvesting or the draining of wetlands, gradually reduces the available resources a species needs to survive. Take away enough of any habitat, and a species with no where else to go will die out in that area and become **extirpated**. Take away the entire habitat anywhere that a particular species requires and it becomes **extinct**.

Another way we threaten plants and animals is by poaching, illegal trade or over-hunting. Many fur-bearing mammals have been coveted for centuries for their beautiful coats. Less flashy animals, such as the prairie dog, were over-hunted due to their designation as pest species. In Arizona, in 1919, 1,601 prairie dogs were killed as part of a Federal-poisoning program. Prairie dogs themselves are not endangered but the animal that depends on them, the Black-footed ferret is. Its main food source was the prairie dog, and prairie dog ‘towns’ are the ferrets’ habitat. This over-hunting of a pest species caused the black-footed ferret to become one of the most endangered species in the United States.

Even plants can be over-harvested. No longer can anyone enjoy the fragrant, sweet smell of the sandalwood tree of the Juan Fernandez Islands off of South America's pacific coast. They were so popular that all of them were cut down. Many cactus species are threatened

because they are being collected for sale as exotic houseplants.

The intentional or accidental introduction of exotic or non-native species can also have an adverse impact. Many native species cannot compete for the available resources or become the prey of a new species for which they have no defenses.

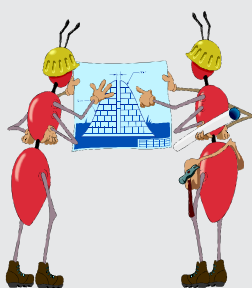
We also interfere with species' abilities to survive by disrupting migratory routes and breeding behaviors, and upsetting the balance of predator and prey through predator control programs such as those aimed at coyotes and wolves.

Another serious problem that endangers all species including humans is pollution. Pollution can be defined as any by-product of human activity that endangers the environment. The four types of pollution are air, land, water, and noise.

In the 1970s, bird watchers noticed a decline in large raptors such as the bald eagle, peregrine falcon and California condor. The decline was eventually linked to a pesticide used to fight insects called DDT (dichloro-diphenyl-tri-chloroethane). These raptors ingested small birds and other animals that fed on insects that had been poisoned. The resulting DDT poisoning caused the birds' eggshells to be thin and likely to break before the chicks could hatch.

Plants act as a natural cleaning service for the atmosphere, absorbing carbon dioxide for use in photosynthesis, thus reducing its levels in the atmosphere, while releasing life-giving oxygen. The increased burning of fossil fuels releases carbon dioxide (CO₂) into the atmosphere, which coupled with a decrease in forestland due clearcutting, means an increase in the concentration of CO₂ – an unhealthy environment for all of us.

An Ant's View of Life – with thanks to National Wildlife Federation
Often, we forget or are unaware of the impact our behavior has on others. By "putting ourselves in someone else's shoes," we can gain understanding and compassion.



Materials — clipboards or sketchpads for each student; pencils, crayons or colored pencils; magnifying glasses or jeweler's loupes.

Step One

Select a natural area around your school. Explain that animals lead complex lives, looking for food, avoiding predators. Now inform your students that they have been transformed into ants for a day. The world looks very different to them now. As ants, they must get as close to the ground as they can. Plants and blades of grass tower over them. Birds and lizards are frightening predators. As they move, they must describe what

they see from an ant's eye view. Have them describe their experiences in narrative form, poetry or blank verse. They can also draw pictures of what they see from their ant's viewpoint. After 20 minutes, return to the classroom and give students time to finish their writing projects and drawings.

Step Two

Have your students share their stories and pictures with the class. Ask them what effect this activity had on them. Do they look at life differently now? Are they more aware of the effects man can have on animals? Did any of them imagine feet descending to stomp on them?

Where in the World?

Students can practice their geography while learning more about endangered plant and animal species in this activity.

Materials – large world map, pushpins, string, pictures of endangered species

Step One

Introduce the subject of endangered species to your students. Point out that many human activities have contributed to the loss of species around the world. To make your example, cut out a picture of an endangered species from a magazine and include information beneath it such as the name of the organism, where it occurs, what type of habitat it lives in, and the reasons for its endangerment. Here is an example:

Name of organism: California Condor
Where it occurs (geographically): Southern California, USA
What type of habitat it lives in: grasslands
Causes of endangerment: hunting, habitat destruction, poison, traps

Explain that the geographic location that a plant or animal is found is not the same as its habitat.

Step Two

Using pushpins, pin your example on the map. Run a string from the picture/description to the species' geographic location on the map. Assign each student an endangered plant or animal to research and then add them to the map, each with its own picture, description.



THE ENDANGERED SPECIES ACT

Conservation is sometimes perceived as stopping everything cold, as holding Whooping Cranes in higher esteem than people. It is up to science to spread the understanding that the choice is not between wild places or people. Rather, it is between a rich or an impoverished existence for Man.

Thomas B. Lovejoy, Conservation Biology, 1980

The Endangered Species Act has been called the most important environmental law ever passed, protecting the ecosystems upon which species depend. It provides a way to conserve plants and animals that are in danger of extinction (endangered species) and those that may become endangered in the foreseeable future (threatened species).

Finding that “various species have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation,” and that “these species “are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people,” Congress passed the Endangered Species Act in 1973. Its purpose is to conserve “the ecosystems upon which endangered and threatened species depend” and to conserve and recover listed species. The U.S. Fish and Wildlife and National Marine Fisheries Services of the Interior Department are responsible for placing species on the endangered species list. They can also remove species that have recovered sufficiently to no longer qualify, or conversely, are now extinct. Under this legislation, a species is designated as **endangered** when it is in danger of **extinction** throughout all or a significant portion of its range, and is unlikely to survive if present conditions continue. A **threatened** species is a species that is likely to become endangered if it is not protected. Once a species is put on the official Endangered Species List (1,400 species worldwide/1,000 in the U.S.), the U.S. Fish and Wildlife Service is then responsible for developing a plan for the species’ recovery and ensures that all government agencies do not jeopardize the species or their habitats. The law was up for reauthorization in 1993, but no action has yet been taken by Congress.

Species are listed on the basis of the best available “scientific and commercial data.” A list of candidate species is also maintained. These are plants and animals that are at risk but have not yet been proposed for listing. Efforts are made to conserve those on the waiting lists to prevent further decline and hopefully eliminate the need for listing.

The goal of the Endangered Species Act is to assist species to recover so that they no longer need protection. The law provides for recovery plans to be developed describing the steps needed to restore a species. “Critical habitat” areas are designated for listed species which include “those physical or biological features essential to the conservation of the species and which may require special management considerations or protection.” This can include areas not currently occupied by the species but that may be needed to ensure its recovery. The recovery plan for the bald eagle emphasized habitat conservation and has been successful in re-establishing the bird in many states. The bald eagle, in fact, has now been down-listed to “threatened” across most of the United States.

Under the law, the protection of threatened species is also undertaken in partnership with state agencies, such as Arizona's Game and Fish Department. Most Arizonans are familiar with the re-introduction program for the Mexican Gray wolf. In 1976, the Mexican Gray wolf was listed as endangered due to aggressive predator control programs. By 1983, the U.S. Fish and Wildlife approved a recovery plan for the wolf that utilized a captive population of 100 wolves managed by 31 zoos and wildlife facilities to re-establish a wild population. Three families of Mexican wolves were re-established on public lands in the Apache National Forest located in eastern Arizona.

Two other recovery plans that are being implemented in Arizona involve the black-footed ferret (Aubrey Valley in northwestern Arizona) and the California condor (Vermilion Cliffs near the Grand Canyon).

The United States also participates in the Convention on International Trade in Endangered Species (CITES) which calls for more than 115 nations to restrict the international trade in endangered and threatened species.

To date, 36% of all threatened and endangered species listed in the U.S. are in stable or improving condition. Without the protection of this law, several species such as the black-footed ferret and the California condor would already be gone. Preserving our biological diversity and protecting threatened species is compatible with sustainable growth. Despite many claims to the contrary, the law blocks very few development projects. Between 1979 and 1992 more than 145,000 federal projects were reviewed under the law and less than 1% were blocked because they would jeopardize a protected species. The Act explicitly requires balancing the protection of a species against the needs of economic development. Only when deciding to list a species does the law look only at the scientific data. Once a species is listed, consideration of socio-economic factors is undertaken when designating critical habitat or deploying a recovery plan. We cannot afford not to protect the plants and animals that share the earth with us. Extinction is forever.

Here Today, Gone Tomorrow – with thanks to Project Wild
This is an advanced project that helps students become familiar with the classification system for animals, allows them to conduct research and make a master list of threatened and endangered species including factors affecting the animals' status.

Step One

Contact the U.S. Fish and Wildlife Service, Office of Endangered Species and obtain the most recent listing of endangered species in the United States. Or get a list of endangered species in Arizona from Arizona Game and Fish (websites are listed under Resources for Teachers.) Ask for information on the reasons for the listings, as well as information on species listed as threatened and those targeted for reintroduction programs. Check with local chapters of national organizations such as the Nature Conservancy or Audubon Society for information they may have on these species.

Step Two

Review with your students the Endangered Species legislation and the meanings of its classifications. How do the definitions of endangered, threatened, etc. compare between a standard dictionary and the legislation?

Step Three

Have each student, or group of students, select an animal to research in depth. Depending on the grade level and student interest, you may want to have each choose a local or national species and one from somewhere else in the world that is facing similar obstacles to its survival.

Step Four

Create a chart based on the students' findings. Categories to include are:

Name of species

Classification on a local, state, national or international level (extinct, extirpated, endangered, and threatened)

Factors affecting species' status

Efforts to save the species (re-introduction program, habitat conservation, etc.)

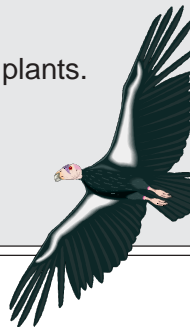
Consequences of the loss of the species (ecologically, economically, aesthetically, intrinsically)

What does the future hold?

Recommendations

Step Five

Try doing this activity with endangered plants.



WHAT CAN YOU DO?

- *Clean up and fix up.* Every time you pick up a piece of litter, you help the habitat. Picking up litter can help beautify and preserve natural areas. Maybe a park fence needs mending or a bench needs repainting to remove graffiti. Sprucing up a natural area makes people enjoy being there and will encourage them to protect it.
- *Avoid using substances that can pollute waterways and habitats.* Pesticides, motor oil, caustic cleaning products, and other pollutants can harm soil, groundwater, and waterways; they also harm plants and animals directly. Never toss such things into the trash. Chemicals deposited in landfills can leach into the ground and pollute soil and groundwater. Use only biodegradable products.

Homemade Helpers

Make your own household cleaners from natural, non-toxic ingredients:

Oven cleaner

2c baking soda
6c water
scouring pad

Disinfectant

dissolve ½c Borax in 1 gallon hot water

Floor and furniture polish

1 part lemon juice
2 parts vegetable oil



- *Conserve resources by reducing, reusing, and recycling.* If we consume fewer resources, we help preserve habitat and create less waste for landfills. Try to reduce the amount of trash you throw away. Start by replacing throwaway items like batteries with reusable ones. Use an insulated bottle for drinks instead of buying individually packaged ones. Use washable cloth napkins and towels, not paper. Reuse or repair items when you can, and recycle everything possible. Contact your department of solid waste to find out what types of materials can be recycled in your community and how they are collected. Turn out the lights and turn off the water when not in use.
- *Plant trees and other native plants, or start a new habitat by creating a natural area in a courtyard, backyard or schoolyard.* Even a single tree can be an important habitat to many animals, and you will begin to increase your backyard's biodiversity. Trees also help clean the air and prevent soil erosion; their shade can help lower fuel costs of air conditioning.
- *Teach others about the importance of habitat and how they can help, too.* Lead youth activities that will let others know about the importance of helping habitats. Design posters and fliers; create bulletin boards for school or displays for local businesses.
- *Do not buy jewelry, souvenir items or apparel made from wild animal products.* Many animals are killed each year to make snakeskin belts, alligator purses, and lizard shoes – and don't forget the thousands of rattlesnakes and scorpions encased in plastic for paper weights and bola ties.
- *Support protection of old growth forests and tropical rainforests by not using exotic hardwoods produced by non-sustainable forestry practices.* These forests provide important wildlife habitat and are often fragile ecosystems themselves.
- *Don't keep exotic pets, they may have been collected illegally, and don't release unwanted exotics into the wild.* These animals are not native to your area and may compete with native animals for food. In addition, they may prey upon native species or transmit

disease for which local species have no natural immunity.

- *Visit zoos, nature centers, wildlife refuges and botanical gardens, in your area.* Learn about issues affecting endangered species. Become active in a conservation group and support efforts to save endangered species.
- *Write letters.* Let others know of your concerns for the environment. Despite citizens' support for species protection, pressure from special interests groups to weaken the law's protections is growing. Write to your congressmen and women and don't forget local lawmakers as well. Below are some organizations to help you get started:

The Children's Rainforest

P.O. Box 936
Lewiston, ME 04240

The National Wildlife Federation

1400 16th Street NW Washington, D.C. 20036-2266
www.nwf.org

The Nature Conservancy

1815 N. Lynn Street Arlington, VA 22209
www.tnc.org

The World Wildlife Fund

1250 24th Street NW Washington, D.C. 20037
www.worldwildlifefund.org

Greenpeace

1436 U Street Washington, D.C. 20009
www.greenpeaceusa.org

Center for Plant Conservation

Missouri Botanical Gardens
P.O. Box 299
St. Louis, Missouri 63166
www.mobot.org/CPC/welcome.html

Cartoons and Bumper Stickers – with thanks to Project Wild



Humor can be a subtle tool in influencing people's attitudes and opinions. The aim of this activity is to examine two forms of humorous media in today's culture and see if they affect people's perceptions of issues affecting natural resources and the environment.

Materials – marking pens, construction paper, drawing paper

Step One

Have your students begin collecting examples of cartoons or bumper stickers that deal with an environment-related issue. You may even want them to save advertisements that feature animals in some stereotypical way or use an animal's "perceived nature" to help "sell" a product. Collect newspapers and magazines to research. Try the library for publications from other parts of the country (do not cut examples from this materials, photocopy them instead!). Create a display of the examples in the classroom.

Step Two

Ask questions about what the students have found:

What topics do the samples focus on? Which elements of the environment or which natural resources are featured? What purpose does the cartoonist, or the ad executive, have in mind? What do they want people to believe? What kinds of feelings or emotions are elicited by the item? What actions do they seem designed to promote? What influence will this have? Has the item been designed to mislead or distort or perpetuate negative stereotypes? How? Are the items designed to inform?

Are they accurate? Do they encourage constructive action and responsible attitudes? How?

Step Three

Have students make their own cartoons, bumper stickers, or advertisements inspired by an environmentally related issue.

Keeping Score – with thanks to Project Wild

We sometimes forget that nature is all around us – in our neighborhoods, at school and down the street at the mall. Students will assess their surroundings to determine the cause and effect relationships affecting wildlife and recommend actions to improve or maintain the quality of wildlife habitat in their community.

Materials – photocopy the “Community Wildlife Scorecard” (p. 21).

Step One

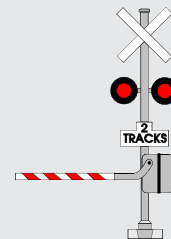
Assign students that task of assessing their neighborhoods, looking for cause and effect relationships that appear to either help or hinder wildlife – and some that may not affect wildlife at all. These could include dogs running loose; trash dumped illegally, homeowners planting native trees, etc. Discuss their findings. What were some of the most surprising observations made? What kinds of actions are people taking that directly affect wildlife? Which are harmful, which are helpful, and which have no effect? What problems were identified? Are there any actions that can be taken to reduce the risk or eliminate the problem?

Step Two

Divide students into small groups and have them share their findings, pooling their observations, eliminating duplicates and thinking about examples of cause and effect relationships that may be happening in the community, but that they may not have actually observed. Ask each group to continue their observations for a week, or longer, and have them keep individual and group Scorecards.

Step Three

Post the class findings to a class Scorecard and tally your results, adding one point for causes that help wildlife, subtracting one point for causes that hurt wildlife and adding no points for causes that do neither. Combine the scores and determine your neighborhood’s Total Wildlife Score. What actions can you take as a class or as individuals to raise your score and maintain or improve the quality of your environment for wildlife?



COMMUNITY WILDLIFE SCORECARD

CAUSE	EFFECT	A Hurts (subtract 1)	B Helps (add 1)	C Neither (no impact)	DATE

Subtotals

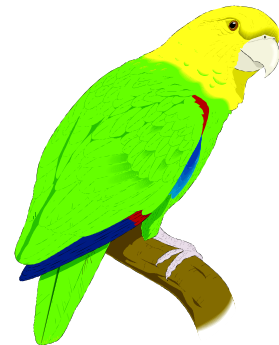
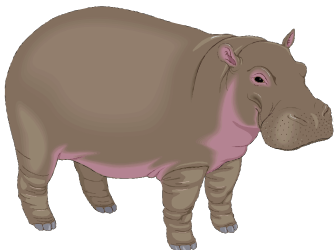
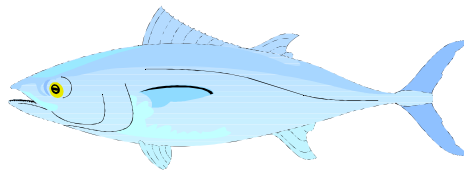
Total Wildlife Score
(subtract Column A from Column B)

TOP TEN MOST ENDANGERED SPECIES OF THE WORLD
WORD WILDLIFE FUND/1994

1. **Tiger:** Tigers face a variety of threats — from habitat loss to poaching. Recently, poaching for their bones and other body parts for use in Oriental medicines has accelerated and has become the most urgent threat to the species survival.
2. **Black Rhino:** Rhinos are killed primarily for their valuable horns, which are ground into powder for use as a fever-reducing agent in traditional oriental medicines and carved into dagger handles in the Middle East.
3. **Giant Panda:** Giant pandas may face extinction before the end of the century if drastic conservation measures are not taken, including habitat protection and the establishment of new reserves, stringent trade controls and anti-poaching measures.
4. **Asiatic Black Bear:** Illegal trade of Asiatic black bear gallbladders imperils this protected large mammal. Gallbladders are used in Oriental medicines to fight fevers and reduce inflammations.
5. **Himalayan Yew:** This slow growing conifer occurs throughout sections of Bhutan, Afghanistan, Pakistan, India, Nepal, Burma, and possibly China. Taxol, the same promising anti-cancer agent, found in the pacific yew, is found in the Himalayan variety. The Himalayan yew is considered rare due to general deforestation and heavy collection for taxol extraction.
6. **Atlantic Bluefin Tuna:** The bluefin tuna, one of the largest fish in the Atlantic, can swim up to 55 miles per hour and migrate thousands of miles in a year. Over-fishing to supply international luxury markets has caused the Western Atlantic population of this species to decline 80% over the last 20 years.
7. **Hawksbill Sea Turtle:** Hawksbill is the principal source of tortoise shell souvenirs and trinkets, although most countries officially ban the trade of hawksbill shell. Their slow reproductive rates make them particularly vulnerable to overexploitation and illegal trade.
8. **Saigo Antelope:** Saigo horn has been used in Chinese traditional medicines for centuries. The horn is used often in medicines in combination with other horn, particularly rhino horn. Whole herds are being wiped out for the trade of their horn.
9. **Egyptian Tortoise:** Highly prized by collectors and sold in the local markets as pets, the Egyptian tortoise is yellow to greenish yellow and only five inches long.
10. **Red and Blue Lory:** These brightly-colored parrots exist in a small range on a few Indonesian islands. A sudden explosion in the international pet and collector trade has wiped out an estimated one-third of the population — with traders taking as many as 700 birds from the wild on one small island chain.

THE RUNNERS-UP

1. **Golden-capped Fruit Bat:** Endemic to the Philippines, it is rapidly declining because of habitat destruction and over-hunting for trade.
2. **American Box Turtle:** Commercialization is restricted in many states, but this has not slowed down trade because of inconsistent or lack of enforcement of existing regulations.
3. **Red Panda:** Faces problems with human encroachment into its habitat and the sale of live animals to zoos and a significant escalation in pelts for sale in local markets. Collectors pay as much as 10,000 yuan (the price of a small car in China) for a live specimen.
4. **African Grey Parrot:** Due to increased collection for the pet trade, this species is threatened in many areas of central and West Africa. It is valued particularly for its ability to mimic human speech.
5. **American or Big-Leaf Mahogany:** New World species is perhaps the most valuable timber in Latin America. Although widely distributed, the species reproduces slowly.
6. **Hippopotamus:** The species is vulnerable to heavy hunting pressures. The increase in international trade is a result of the growing use of hippo ivory (in the form of its teeth) as a substitute for elephant ivory. There has been notable increase in hippo teeth trade since African elephant ivory was banned from international commerce in 1989.



ENDANGERED SPECIES OF ARIZONA

1. Name: ***American Peregrine Falcon***
Status: Endangered due to reproductive failure from pesticides
Counties: Mojave, Coconino, Navajo, Apache, Santa Cruz, Maricopa, Cochise, Yavapai, Gila, Pinal, Pima, Greenlee, and Graham
Description: A reclusive, crow sized falcon, slatey blue above whitish below; head is black and appears to be masked or helmeted
Size: *Length* 15-21 inches (38-53cm); *Wingspan* 44 inches (112cm)
Habitat: Cliffs and steep terrain, usually near water or woodlands with abundant prey
Animal Fact: Can reach speeds of 60mph in level flight, and can dive to catch prey at speeds exceeding 200mph

2. Name: ***Arizona Hedgehog Cactus***
Status: Endangered due to limited distribution, off-road vehicle use, and illegal collecting
Counties: Maricopa, Gila, and Pinal
Description: Dark green cylindrical cactus, 2.5-12 inches tall, 2-10 inches in diameter, single or multiple clusters; 1-3 gray or pinkish central spines and 5- 1 shorter radial spines; bright red flowers Apr-May
Habitat: Sides of canyons and sloping rock-piles in interior chaparral and woodland
Plant Fact: Can be found in narrow cracks between boulders and under shrubs

3. Name: ***Pima Pineapple Cactus***
Status: Endangered due to urbanization, illegal collecting and introduction of non-native species
Counties: Pima, Santa Cruz
Description: Hemispherical stems 4-7 inches tall and 3-4 inches in diameter; central spine 1 inch long; straw colored hooked surrounded by 6-15 radial spines; flowers yellow, salmon, or rarely white with a narrow floral tube
Habitat: Sonoran desertscrub or semi-desert grassland communities at 2300-5000 ft.
Plant Fact: Often confused with the juvenile barrel cactus

4. Name: ***Black-footed Ferret***
Status: Endangered due to loss of habitat, prairie dog villages; the intensive hunting of prairie dogs as a pest species has resulted in the serious decline in ferret numbers
Counties: Coconino, Apache, and Navajo
Description: Weasel-like; yellow buff coloration with black feet, tail tip, and eye mask

Tohono Chul Park  Endangered Species: Saving the Ark

Size: *Length* 5-18 inches, tail 5-6 inches
Habitat: Grassland plains found in association with prairie dogs
Animal Fact: The only native ferret known to North America

5. Name: ***Cactus Ferruginous Pygmy-Owl***
Status: Endangered due to loss of habitat
Counties: Maricopa, Yuma, Santa Cruz, Graham, Greenlee, Pima, Pinal, Gila, and Yavapai
Description: A small bird; reddish-brown, with a cream colored belly streaked with reddish-brown; some individuals are grayish
Size: *Length* 6.75 inches (17cm) *Weight* Males 2.2 oz, Females 2.6 oz
Habitat: Mature cottonwood/willow, mesquite bosques, and Sonoran Desert scrub
Animal Fact: Lays 3-5 eggs each year, incubates them for 28 days

6. Name: ***California Condor***
Status: Endangered due to hunting and poisoning
Counties: Mojave, Coconino, and Apache
Description: Very large vulture; adult plumage blackish, immature more brown; adult wing linings white, immature mottled; head and upper parts of neck bare; yellow-orange in adults, grayish in immature birds
Size: *Length* 46-55 inches; *Wingspan* 9.8 feet
Habitat: High desert canyonlands and plateaus
Animal Fact: Normally lays 1 egg every other year in the wild; up to 3 eggs per year in captivity

7. Name: ***Desert Pupfish***
Status: Endangered due to loss of habitat and introduction of non-native fish
Counties: La Paz, Pima, Graham, Maricopa, Pinal, Yavapai, and Santa Cruz
Description: Small smoothly rounded body shape, with 6-9 dark bands on its sides; breeding males blue on head and sides with a yellow tail; females and juveniles tan to olive colored back and silvery sides
Size: *Length* 2-2.5 inches
Habitat: Shallow springs, small streams, and marshes; tolerates saline and warm waters
Animal Fact: Average life span is 6-9 months

8. Name: ***Gila Topminnow***
Status: Endangered due to loss of habitat and introduction of non-native fish
Counties: Gila, Pinal, Graham, Yavapai, Santa Cruz, Pima, Maricopa, and La Paz
Description: Small, guppy-like, but lacks dark spots on its fins; breeding males are jet black with yellow fins
Size: *Length* 1.2-2 inches
Habitat: Small streams, springs, and cienega's vegetated shallows

Animal fact: Bear live young

9. Name: ***Jaguar***
Status: Endangered due to overhunting for its fur or by ranchers as a predator, habitat loss
Counties: Cochise, Pima, and Santa Cruz
Description: Muscular and compact body; massive limbs and a deep-chested body; coat is a cinnamon buff with a pale chest and black spots; lower part of tail is ringed with black, and ears have black edges
Size: *Length* 5-6 feet from head to tip of tail; *Weight* 140-220 pounds
Habitat: In Arizona, a variety of habitats from Sonoran desert to conifer forests
Animal Fact: Females care got 1-4 young who remain with her for 2 years
10. Name: ***Lesser Long-Nosed Bat***
Status: Endangered due to loss of habitat
Counties: Cochise, Pima, Santa Cruz, Graham, Pinal, and Maricopa
Description: Elongated muzzle, small leaf nose, and long tongue; yellowish brown or gray above and cinnamon brown below; tail minute and almost appears to be lacking; easily disturbed
Size: *Forearm* 5.1-5.6cm; *Wingspan* 36-38.5 cm
Habitat: Forms colonies in caves and abandoned mines, living mostly in desertscrub with agave and columnar cacti present as food plant
Animal Fact: The survival of many desert plants is dependent on bats, which are key pollinators of many agaves, saguaros, and organ pipe cacti
11. Name: ***Mexican Gray Wolf***
Status: Endangered due to predator control programs run by individuals as well as local, state and federal governments
Counties: Cochise, Pima, and Santa Cruz
Description: Large dog-like carnivore with varying color, but usually a shade of gray; distinct white lip line around mouth
Size: *Length* 5-6 feet; *Height* 36-40 inches; *Weight* 100-175 pounds; females are slightly smaller
Habitat: Chaparral, woodland, and forested areas
Animal Fact: Wolves can run up to 45mph
12. Name: ***Mojave Desert Tortoise***
Status: Threatened due to loss of habitat, poaching, collection for pets, and livestock trampling
Counties: Mojave
Description: Large herbivorous reptile with domed shell and round stumpy hind legs
Size: *Length* 9-15 inches
Habitat: Mojave desertscrub north and east of the Colorado River

Animal Fact: Tortoises can go for years without drinking, obtaining most of their water from their diet, and storing it in their bladders

13. Name: ***Mt. Graham Red Squirrel***
Status: Endangered due to loss of habitat
Counties: Graham
Description: Grayish-brown tinged rusty or yellowish on the back; in summer, dark lateral line separates the light undersides from the gray sides; tails are bushy
Size: *Length* 12.8 inches from head to tail
Habitat: Montane upper elevation mature to old-growth conifer forest
Animal Fact: Squirrel's diet is primarily conifer seeds
14. Name: ***Sonoran Tiger Salamander***
Status: Endangered due to loss of habitat
Counties: Santa Cruz, Cochise
Description: Light-colored bands on a dark background
Size: *Length* 3 to 6.5 inches
Habitat: Stock tanks and impounded cienegas in San Rafael Valley and Huachuca Mountains
Animal Fact: These salamanders have 11-50 (avg.32) yellow to dark olive spots between their fore- and hind limbs
15. Name: ***Sonoran Pronghorn***
Status: Endangered due to loss of habitat
Counties: Pima, Yuma, and Maricopa
Description: Buff on back and white below, hoofed with slightly curved black horns having a single prong
Size: *Length* 53 inches; *Weight* 75-130 pounds
Habitat: Intermountain valleys with creosote-bursage and Palo Verde linked cacti
Animal Fact: Pronghorn have a top speed of 60mph

Resources for Teachers

Habitat Ecology Learning Program (HELP) a six-module, interdisciplinary curriculum for grades 4-6 published by the Wildlife Conservation Society that focuses on world habitats (deserts, grasslands, rain forests, temperate forests, and wetlands) and conservation issues:

Education Department

Bronx Zoo

2300 Southern Boulevard

Bronx, NY 10460

1-800-937-5131

www.wcs.org

Ranger Rick's Nature Scope series – Endangered Species: Wild and Rare and Animal Tracks Activity Guide for Educators Grade 4-6, Published by the National Wildlife Federation, 1995

NWF

8925 Leesburg

Pike, Vienna, VA 22184

1-800-822-9919

Taking Action: An Educator's Guide to Involving Student in Environmental Action Projects, ideas and models for conducting environmental projects in the classroom; and *WILD School Sites* — Project WILD's guide to improving habitats on school grounds (56-page guide tells how to begin a project and lists activities from Project WILD that relate) are both available from:

Project WILD

5430 Grosvenor Lane

Bethesda, MD 20814

301-493-5447

www.projectwild.org

The Endangered Species Handbook. By Greta Nilsson. 1986 — an excellent resource and compendium of background information; free to teachers if request is written on school stationary.

Animal Welfare Institute

P.O. Box 3650

Washington, D.C., 20007

Endangered Animals Teaching Unit, Leigh Childs, Lois Schwartts, and Jeff Swenerton, 1984 — includes teacher's guide, student reader, and activity sheets.

Zoo Books

Wildlife Education Limited

930 West Washington St.

San Diego, CA 92103

Endangered Species Issue Pac, U.S. Fish and Wildlife Service and the National Institute for Urban Wildlife — includes color poster, teacher overview, lesson plans, and student activity pages.

National Institute for Urban Wildlife
10921 Trotting Ridge Way
Columbia, MD 21044

The Natural Habitat Garden, by Ken Druse (1994, Crown Publishers)

Living Treasure - Saving Earth's Threatened Biodiversity by Laurence Pringle (1991, Morrow Junior Books)

Our Endangered Planet - Life on Land, by Mary Hoff and Mary M. Rodgers (1992, Lerner Publications Company, Minneapolis)

Extinctions, by Paul and Anne Ehrlich (1981, Random House)

For Kids Who Love Animals - A Guide to Sharing the Planet by Linda Koebner (1991, Living Planet Press, Los Angeles)

Habitats - Saving Wild Places, by Dorothy Hinshaw Patent (1993, Enslow Publishers, Inc.)

The Endangered Species Act, by Daniel J. Rolf (1989, Stanford Environmental Law Society)

Endangered Species - Understanding Words in Context by Robert Anderson (1991, Greenhaven Press, Inc.)

The Sinking Ark — A New Look at the Problem of Disappearing Species, by Norman Myers (1979, Pergamon Press)

Peterson First Guides Field Guides, published by Houghton Mifflin and field guides from the National Audubon Society are excellent for children and adults

U.S. Fish and Wildlife Service
www.fws.gov/r9endspp/endspp.html

Arizona Game and Fish Department
www.gf.state.az.us

CITES – Convention on International Trade in Endangered Species
www.wcmc.org.uk:80/CITES/

IUCN Lists of Threatened Species
www.iucn.org/themes/ssc/IUCNREDLIST/REDLIST.HTM

EE-link of Endangered Species
www.eelink.net/EndSpp/Endangered.html

Desert Tortoise Preserve Committee
www.tortoise-tracks.org/dtpc.html

California Tortoise and Turtle Club
www.tortoise.org

Bat Conservation International
www.bci.org

EPA Endangered Species Coloring Book
www.epa.gov/espp/coloring/doc18.htm

Organ Pipe Cactus National Monument — pronghorn
www.nps.gov/orpi/

The Pronghorn – America’s Fastest Mammal
www.geobop.com/Mammals/Artiodactyla/Antilocapridae/index.htm

Effects of Aircraft Noise and Sonic Booms on Wildlife
www.nonoise.org/library/fishwild/survey.htm

Restoring America’s Wolves
www.nwf.org/wolves/index.htm

Mexican Wolf Recovery Program
www.ifw2.fws.gov/wolf

Wold Education and Research Center
www.wolfcenter.org

International Wolf Center
www.wolf.org

Resources for Students

Animal Tracks, published by National Wildlife Federation, 1995 — companion workbook to the Animal Tracks Activity Guide

The Empty Lot, by Dale Fife (1991, Little Brown) grades K-4

Endangered Habitats, by Jenny Tesar (1992, Facts On File) grades 6 and up

Tohono Chul Park  Endangered Species: Saving the Ark

The Ever-living Tree: The Life and Times of a Coast Redwood, by Linda Vicira (1994, Walker & Co.) grades 2-4

A Gift of a Tree, book and starter kit with seeds to plant a tree, by Greg Henry Quinn (1994, Scholastic) grades K-3

The Lorax, by Dr. Seuss (1971, Random House) all ages

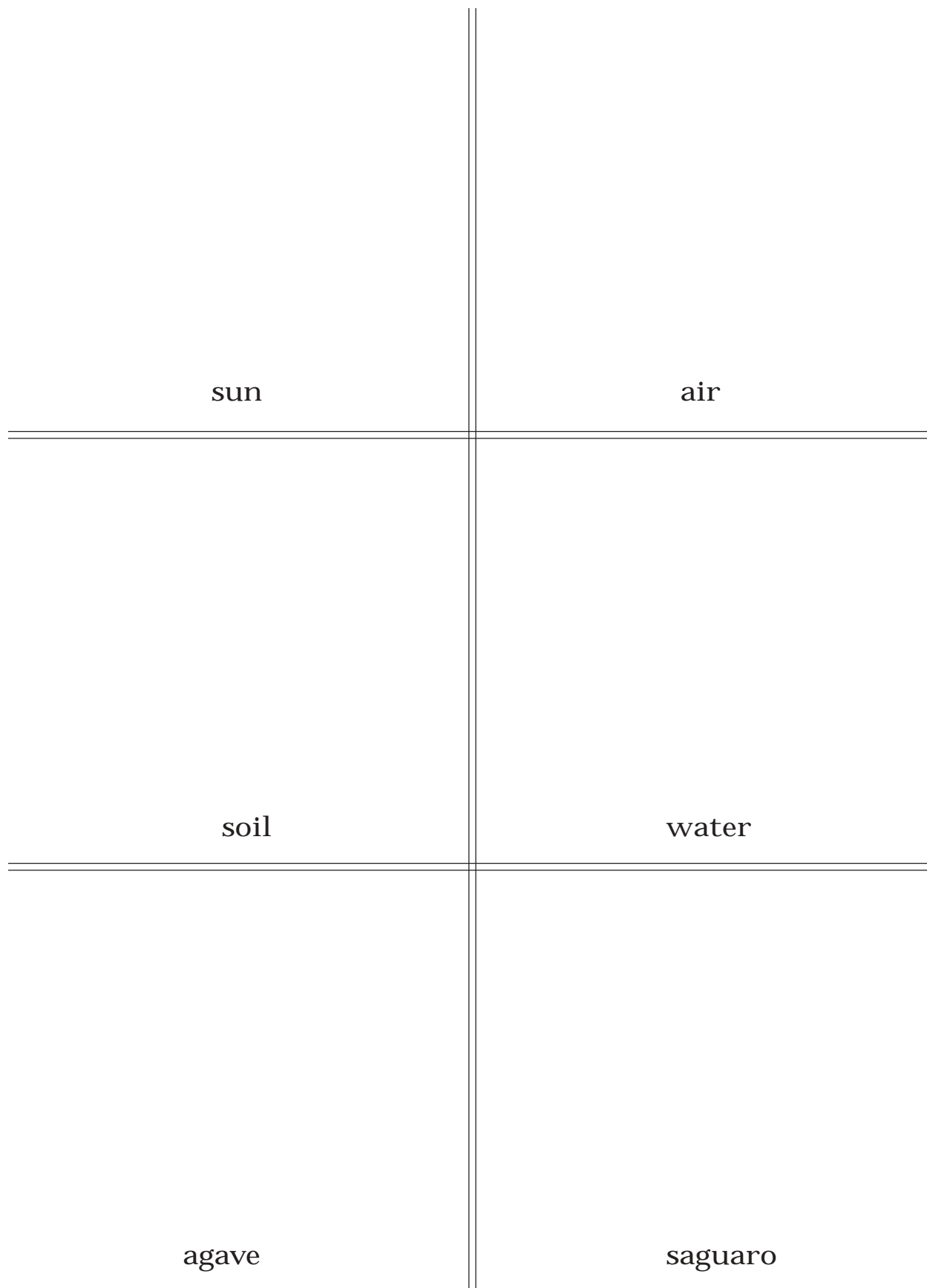
The Great Kapok Tree: A Tale of the Amazon Rainforest, by Lynne Cherry (1990, Harcourt Brace & Co.) all ages

Endangered Animals, a series by J.M. Roever (1972, Steck-Vaughn) grades 4-6

Endangered Animals, by Dean Morris (1990, Raintree) grades 1-3

Endangered Plants, by Dorothy Childs Hogner (1977, Corwell) grades 4-6

Living Treasures: Saving Earth's Threatened Biodiversity, by Laurence Pringle (1991, Morrow) grades 4-8





prickly pear

mesquite

grasses

wildflowers

scorpion

tarantula



butterfly

ants

praying mantis

rattlesnake

tortoise

whiptail lizard



horned lizard

roadrunner

hummingbird

quail

red-tailed hawk

great horned owl



javelina

jackrabbit

kangaroo rat

coyote

bobcat

gila monster

Find three different sized leaves from the same plant.

Find at least three different kinds of plants growing under a tree.

**Find at least three different organisms;
give them descriptive names.**

Find a plant that has three different colors.

Find at least three different kinds of seeds.

Find three different flowers.

Find at least three different kinds of holes made by animals.

Find three different signs of an animal having eaten something.

Find at least three different kinds of leaves.

Find at least three leaves with different textures.

Find at least three different plants.

Find three different consumers, or evidence of them.

Find three different decomposers.

Find at least three plants with different odors.

Find at least three different insects.

Find three different succulents.

Find three different birds.

Find a biodiverse place.