

Endangered Species

Background

Within 50 years, the African elephant may become extinct in parts of Africa. Statements like this are being more frequently heard as an increasing number of species are identified as being on the verge of extinction. The African elephant population is roughly half of what it was only 40 years ago. For years these animals were hunted and slaughtered for the ivory trade. More recently, bans on hunting and trading have helped protect the animals, but now they face another challenge: human land use practices. To meet their dietary and reproductive needs, elephants need a lot of room to roam. This can create conflict when, for instance, their habitat is appropriated by humans for agriculture—elephants have been known to roam right over farmlands and through fields of crops. The struggle for sustainable coexistence between humans and other species is a constant, but constantly changing, challenge for conservationists.

One of the most frequent causes of species endangerment is habitat loss and destruction. It is also the leading cause of population loss resulting in endangered status; this occurs frequently with species that exist only in very small habitats. As human populations grow and the amount of resources that are consumed increases, undisturbed forests are cut or burned and cleared to build farms, coastal areas become crowded with houses and hotels, and prairies and grasslands become mining sites. When this occurs, the resident organisms either seek shelter in the remaining natural areas, adapt to living among humans, or risk predation and other dangers by living in close proximity to humans. When habitats are destroyed, populations of organisms must adapt to survive on fewer resources, but often the result is a decrease in the population. For example, pandas in China feed on bamboo shoots. When bamboo forests are destroyed, there is less food and shelter available to support the existing panda population. The carrying capacity of the region decreases, and competition increases among the remaining individuals, some of whom may not survive. Many conservation efforts focus on preservation of an entire habitat—such as a forest, a coral reef, or range of sand dunes—as the most effective means of conserving a species.

Exotic species are non-native organisms introduced deliberately or accidentally into a habitat. Some alien species are introduced and temporarily thrive before dying out or maintaining a small population. Others expand their range with increasing ecological, economic, and environmental consequences; these are considered invasive species. Kudzu, for example, is a plant introduced in the late 1800s as an ornamental vine and later encouraged as an effective means of erosion control. It has subsequently had a tremendous negative impact on native plants in the southeastern U.S., blanketing them under a thick covering of leaves that block light and a tangle of vines that weighs down branches. Nonnative plants and animals often out-compete native species for food or habitat. This was the case, for instance, when the zebra mussel was accidentally introduced to the freshwaters of the U.S. It brought many native mussel species to the brink of extinction by eating the food particles that the native mollusks normally ate, and by attaching to the native organisms' shells in such numbers that the native species were smothered. Zebra mussels are a problem for humans, too, because they attach not only to mollusks, but also to underwater machinery (at power generating stations, etc.) where they frequently foul or damage the machines. The mussels' filter-feeding "cleans" murky waters, giving the impression of improvements in water quality; however, the original murkiness was due in part to the microscopic algae responsible for primary productivity. The mussels have, instead, disrupted the entire food web in many areas they have invaded.

Overharvesting, which includes hunting and fishing, also can reduce biological diversity as species are removed from their habitat for human use or consumption. Overfishing and harvesting have had a profound effect on many populations, including whales, for example. In many cases, direct population losses affect the populations of other species, including those that depend on the overharvested species as a food source. The hunting or collecting of certain animals or plants whose parts are seen to have a medicinal or other traditional use can lead to the exploitation of a species. Ironically, and tragically for the organism, the rarer such a species becomes, the more profitable it is on the black market.

Recently, climate change has gained attention as a potential threat to many species. The Fourth Assessment Report of the United Nations Intergovernmental Panel on Climate Change, published in 2007, concluded that in the next century climate change could be catastrophic for many ecosystems, noting that extinction becomes increasingly likely for a larger percentage of the Earth's species as temperatures rise. Record temperature increases documented in the Arctic and Antarctic already are causing ice floes to melt, reducing the amount of habitat available to polar-dwelling species. As the polar ice sheets recede, the populations of dependent species are increasingly threatened.

Other factors that can lead to the endangerment of a particular species include disease and pollution. Predators, and consumers in general, often are especially vulnerable to the effects of pollution. A classic example of this phenomenon is the decline of raptors and fish-eating seabirds due to their intake of the pesticide DDT, which was widely used in the 1950s and 1960s. Disease agents, such as fungal parasites of plants, can devastate a species, particularly if that species developed in isolation from the disease organism. In fact, disease outbreaks sometimes occur in tandem with the problem of exotic species as fungal, bacterial, or viral pathogens are introduced to a region through the importation of plants or animals harboring the disease.

It is important to note that humans are not responsible for all extinctions that occur. Natural, slowly occurring changes also can affect the balance of ecosystems and lead to reductions in the populations of certain species. Succession is a natural process in which some species are gradually displaced as others more suited to the habitat thrive. Throughout natural history, there have been numerous periods characterized by mass extinctions during which countless species died out in a relatively brief period. Scientists theorize that these mass extinctions have been due to a number of cataclysmic global events taking place over Earth's history, including climate change, large-scale volcanic activity, and even massive meteorite impacts.

Objective(s)

- ✓ to learn about different plants and animals that are threatened or endangered
- ✓ to be able to define and explain what it means for a species to be endangered
- ✓ to be able to identify threats that can lead to population decline
- ✓ to understand how different species are affected by various environmental factors and threats
- ✓ to draw conclusions about the importance of conservation efforts for the protection and recovery of threatened and endangered species

Materials

- species card
- threat cards (x5)
- cup
- chips (x10)

Pre-Lab Questions

Answer the following questions on your lab paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences and show your work for math problems.

1. What are the levels of conservation status that are applied to species? Describe the characteristics of each level.
2. Other than direct human activity, like deforestation that removes/destroys habitats for organisms, what **indirect** (unintentional or unintended) threats due to human activity are present for species survival?

Safety

★ *There are no special safety precautions for this activity*

Procedure

In the Struggle for Survival game, you will take on the role of a unique threatened or endangered species, as indicated on your Species Card. In addition to some facts about the species, the back of the card lists the most significant threat or threats to the continued survival of the species. Throughout the game you will pair up with other students and trade Threat Cards. If you draw a Threat Card that corresponds to a threat faced by the species on your card, discard one of your chips into the discard cup. Each chip you possess represents a fraction of your species' population. When you run out of chips, your species is extinct. However, for every

Conservation Card that you draw or receive, you can retrieve a chip from the discard pile. Will you be able to save your species in the Struggle for Survival?

1. Read about the organism on your Species Card, making special note of the threat or threats listed on the back of the card.
2. Pair up with another student for the first round. Hold out your Threat Cards face-down. Take turns drawing one card from your partner's deck of Threat Cards.
3. If you draw a Threat Card that corresponds with a threat faced by your species, remove a chip from your plastic cup and discard it into the discard pile. This represents harm done to your population by that threat.
4. Keep the Threat Card you selected and incorporate it into your hand.
5. Throughout the game, Conservation Cards will be distributed at random by your instructor or a designated individual. Each Conservation Card represents human efforts to protect an endangered species. Drawing a Conservation Card or being given one by the designated distributor allows the recipient to retrieve one chip from those that have been discarded. If you receive a Conservation Card, add it to your hand; it can now be drawn by another student. Each time you receive a Conservation Card you can retrieve a chip from the discard pile, even if it means your species exceeds its original population size.
6. Pair up with a new partner and draw another card, and discard or retrieve chips according to the preceding rules.
7. Continue to swap cards and add or subtract from your species population, each time with a new partner.
8. If you run out of chips, your species has become extinct and you are out of the game. Take your hand of cards out of play.

Clean Up

- ✓ everything returned to its original location

Results & Analysis

Answer the following questions on your lab paper. For actual questions, you must either write out the questions, or include the questions in your responses. Be sure to use complete sentences and show your work for math problems.

1. Make a list of plant and animal species, other than those you encountered in the Struggle for Survival game, which you think are or could be endangered.
2. List the threats noted on the Threat Cards you encountered during the Struggle for Survival game. Choose one species from the list you made in Question 1, and describe how one or more of these threats could cause that species to become endangered or extinct.
3. Yellowstone National Park supports a population of bison, the largest land mammal in North America. Within the park, the bison is now protected from hunting and habitat destruction. However, back in 1902, poaching had reduced the population of bison in the park to approximately two dozen. What do you perceive to be the challenges of protecting endangered species, given the example of the Yellowstone bison population?
4. In the Struggle for Survival game, Conservation Cards helped to keep species from becoming extinct. In the real world, conservation efforts are often focused on specific species or on specific habitats. Describe how conservation efforts that are focused on one species can ultimately benefit multiple species.
5. Survey the list of species you encountered during the Struggle for Survival game. What conclusions can you draw about the types of organisms that are endangered?
6. Each species in a particular ecosystem interacts with other organisms and its environment in a specific manner, known as its niche. When a species becomes extinct, its niche becomes vacant. Consider that the Thomson's gazelle is a major food source for many predators, including the cheetah and African lion. Describe the effects on the ecosystem if the Thomson's gazelle were to go extinct.