

## Reflect

Almost everyone is familiar with the extinction of dinosaurs, but we often don't think about the millions of other species that have become extinct. What is extinction, exactly? What causes extinction? Is extinction something that only happened in the past? Could it be happening now to species we are familiar with? Under what conditions does extinction take place?

**extinction:** the point when there are no remaining members of a particular species

**Extinction** is generally thought of as the dying off of all members of a species, which can no longer reproduce due to environmental constraints.



The *Archaeopteryx* represents a transition between dinosaurs and birds. It is believed to have become extinct about 150 million years ago.

## What Causes Extinction?

Environment change over both brief and very long periods of time. This influences the availability of resources and the conditions upon which living things in that area depend to survive. Environmental changes compel organisms to adjust in one way or another. Sometimes, organisms can simply relocate to an area unaffected by the change. In many cases, only those individuals within the population who adapt to the change will survive. This is one of the mechanisms that contributes to the evolution of species. However, in some situations, the change to the environment is too extreme or happens too quickly, which can cause all members of the species to die off. With no remaining members of the species left to reproduce, the entire species disappears.

## What Kinds of Environmental Change Cause Extinction?

Consider a species of tree lizard that lived in an era even before dinosaurs roamed Earth. During this particular era, approximately 200 million years ago, an event took place in the Central Atlantic Magmatic Province. This event consisted of massive volcanic eruptions that might have lasted more than 600,000 years. These eruptions released gases into the atmosphere and led to global warming. The tree lizard species was not able to survive this shift in temperature, and every member of its species eventually died.



## Reflect

The example of the tree lizard illustrates just one type of environmental change (global warming) caused by one type of event (volcanic activity). Throughout the history of Earth, there have been many different types of environmental changes that affect the number and types of species that live.

**biodiversity:** a measure of the number of different types of species in any given ecosystem

An extinction event typically reduces **biodiversity**. Ecosystems with a higher number of different types of species are generally considered to be healthier and more sustainable than ecosystems that can only support a smaller number of different species. Most scientists agree that there have been five periods of mass extinction that drastically reduced biodiversity on Earth.

**global warming:** an increase in the average daily temperature on Earth. Usually caused by an increase in the concentration of carbon dioxide gas in the atmosphere

**pH:** a measure of the acidity or basicity of a substance

**drought:** a time period of little or no rain

In fact, due to these massive extinctions and other smaller ones throughout history, an estimated 99.9% of all living things that ever lived on Earth have gone extinct. One of these mass extinction events occurred about 439 million years ago. This event was caused by a drop in sea levels and marked the disappearance of more than half of the plant and animal species living in the oceans. Other types of environmental change that can cause extinction include wildfires, **drought**, flooding, change in atmospheric conditions, change in soil **pH**, change in pH of water, and many more.

**fossil record:** the use of fossils found within layers of rock to study the history of life on Earth

This species of fish is just one of many marine species that are now extinct.



## How Do We Study Extinction?

Most of what we know about extinction of species comes from studying the **fossil record**. Scientists are not only able to gain understanding about the types of organisms that were alive at certain points in Earth's history, they can also learn about the lifestyle of those organisms by looking at the types of plants found in the same layer of rock at the same location. With clues from the fossil record, scientists can begin to understand what conditions on Earth were like during that time. By studying plant and animal fossils, the characteristics of the rock itself, and changes from one layer of rock to the next, scientists are able to formulate an idea of how species changed over time, which species have become extinct, and what conditions might have led to their extinction.



Scientists study rock layers to find evidence about organisms that once lived on Earth.

## Look Out!

Many environmental changes happen naturally. These natural changes may occur slowly, over hundreds, thousands, or even millions of years. Or the changes may happen more quickly over a smaller area. It is important to remember, too, that human beings also influence the environment in ways that can affect the survivability of other species. Many scientists believe that we are currently facing the sixth mass extinction in the history of Earth, and humans are to blame. Can you think of a few ways that humans could be contributing to the extinction of modern species?

When the number of individuals of a certain species fall below acceptable limits, the species is considered endangered. Many protective measures can be taken to conserve these species and maintain biodiversity in the ecosystem.



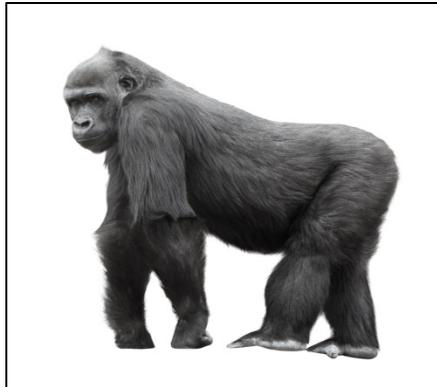
The Tasmanian devil is considered an endangered species. Its habitat is limited to the small Australian island, Tasmania. What factors could be contributing to its endangerment?

## What Do You Think?

Is extinction always a bad thing? In what ways does extinction change the history of life on Earth? Think about the extinction of the dinosaurs. If dinosaurs had not gone extinct, would it be possible for large mammals (including humans) to evolve on Earth? Why or why not? Who do you think should be allowed to make decisions about which species should be conserved and which should go extinct? The pictures below show a few more species that are considered endangered. Which of these are worth conserving? Why?



Giant panda bear: approximately 1,800 remain in the wild



Mountain gorilla: approximately 900 remain in the wild



African wild dog: approximately 6,600 remain in the wild

## Try Now

In the table below, the left column lists five descriptions of changes to the environment. Consider the effects of these specific changes to the species living in these areas. Below the table is a list of five possible effects. Match each environmental change to the appropriate possible effect by writing the corresponding number in the right column.

Environmental Change	Possible Effects
Prolonged periods of volcanic activity spew gases into the atmosphere	
Sea water turns to ice, forming glaciers and reducing sea level	
Heavy rainfall covers an area under several feet of water for an extended amount of time	
A meteorite impacts Earth, creating a large crater and kicking up debris into the atmosphere, blocking sunlight	
Humans harvest trees from a large forest for the purposes of building structures	

1. Average temperatures drop drastically, killing many species of plant and causing plant-eaters to starve
2. Marine habitat size decreases, increasing competition between sea plants and animals
3. Plant and animal species drown
4. Tree-dwelling creatures lose suitable habitat; plants that prefer shade are exposed to sunlight and perish
5. Average temperatures increase due to global warming effect. Plants and animals cannot withstand higher temperatures.

## Connecting With Your Child

### Changes on Earth

Your child may be interested in the changes that have occurred throughout Earth's very long history. This may be a good time to take a visit to a local science museum to view fossils of once-living organisms and discuss the relationship between their adaptations and their likelihood of survival in the face of environmental change.

Your child may also become interested in conservation efforts and measures that have been taken to prevent the loss of additional species. Weigh both sides of this argument. Remember that in the five previous periods of mass extinction, there were no conservation efforts.

This may potentially lead to discussions about evolution of species over time. Remember that evolution, simply put, refers to the change in the adaptation of species pressured by environmental conditions. Find examples of species that once lived in your area but are now extinct, and compare them to species that have been around for a long time but may have changed slightly.

Here are some questions to discuss with your child:

- Is extinction an important part of Earth's history that frees up resources for new species to evolve?
- What is the benefit of maintaining biodiversity?
- What is the relationship between extinction and evolution?