

**Build**  
THE **Change**



This guide is designed to support educators teaching students about the impact that humans have on the environment. Appropriate for grades 4 through 8, this resource is designed to complement The LEGO Group's [Human Impact course pack](#). The Human Impact course pack introduces the concepts of negative and positive human impacts on the planet using the example of birds – “today’s dinosaurs” – and challenges students to build and share their own imaginative solutions to the real-world challenges of designing a world where human and nature can successfully coexist.

This supplemental resource provides an overview of the history of human impact on the environment, as well as activities that allow students to practice relevant skills as defined by the [National Science Teaching Association standards for middle school students](#). Using this resource, you will be able to 1) explain the origins and evolution of human impact, 2) help students understand why they should care about the impact of human activity, and 3) understand the complexity of human impact and the considerations necessary to balance the needs of societal progress with environmental impacts.

### Like this resource?

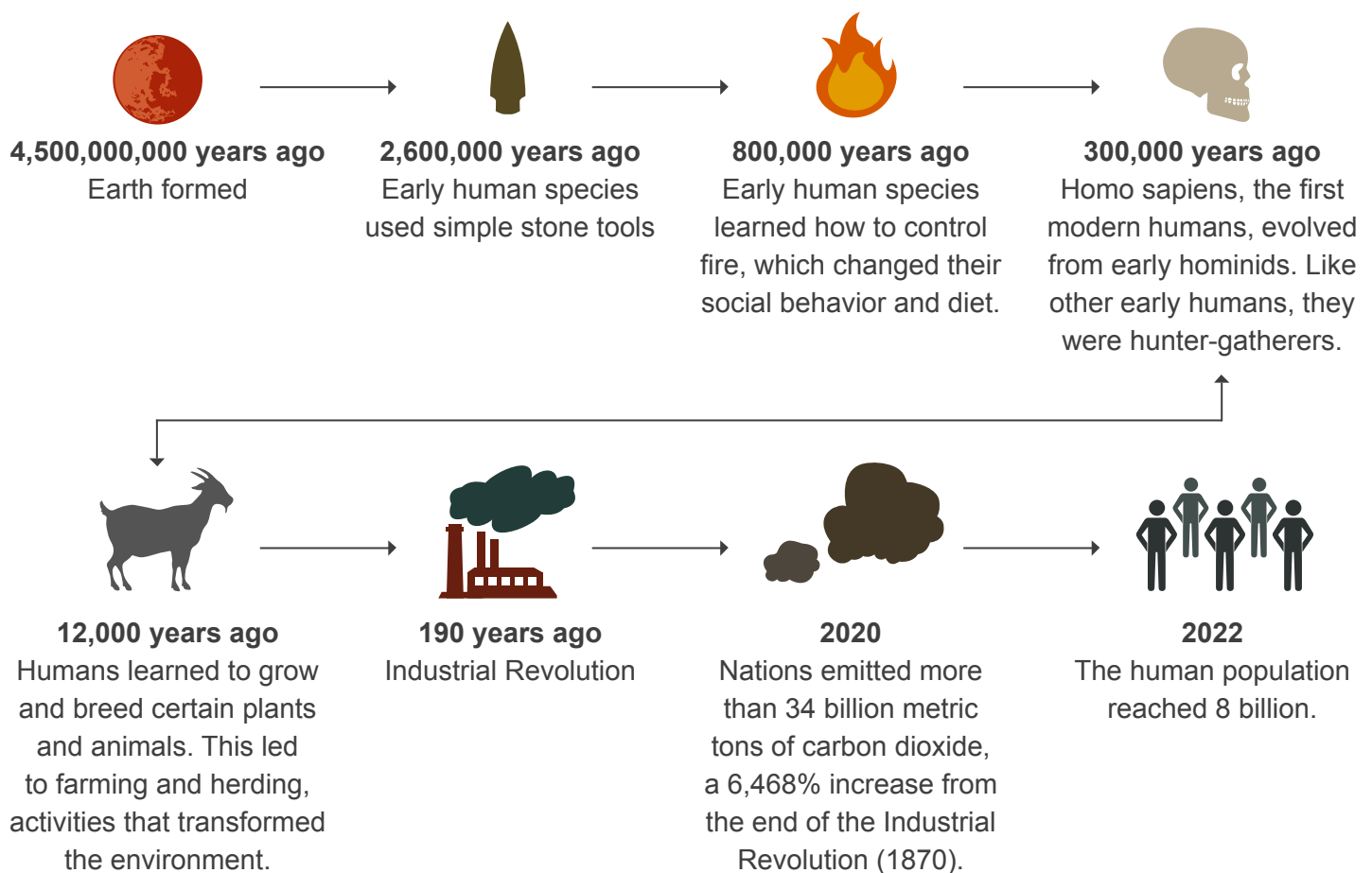
Be sure to check out First Book's other environmental science resources including [Climate Change in the U.S.](#) and [A Future Without Waste](#) and The LEGO Group's Build the Change Course Packs: [Biodiversity and Climate Change](#) and [A Future Without Waste](#).

# PART I: THE HISTORY OF HUMAN IMPACT ON THE ENVIRONMENT

## The History of Human Impact

The Earth is about 4.5 billion years old. Although it can be hard to imagine a time before people populated the Earth, humans have been part of the picture for less than 1 percent of the Earth's existence — approximately 6 million years.

### TIMELINE



Sources: [Smithsonian National Museum of Natural History](#), [Smithsonian Magazine](#) & [Statista](#)

Humans have had a big impact on the planet during the relatively short time we have lived on Earth. Scientists have named this period of human activity the Anthropocene Epoch. In the Anthropocene Epoch, human action has been the main cause of change to our planet. Scientists think there are no ecosystems left on Earth that have not been affected by human activity.

Use the Smithsonian National Museum of Natural History's [interactive timeline](#) to see how the climate has fluctuated over the course of human evolution.

Here are a few ways humans have altered the planet:

- 1 **The extinction of megafauna.** Humans are not to blame for the extinction of the dinosaurs because that happened many millions of years before humans appeared on Earth. But humans are likely responsible for the extinction of some kinds of megafauna, or large animals. Every continent used to have large animals like elephants, giant sloths, giraffes, and hippos. These animals are now found only in Africa and India. Using the fossil record, scientists discovered that these large animals disappeared on other continents soon after humans arrived. This evidence suggests that the human impact of hunting these large animals for food was a factor in their extinction.

DID YOU  
KNOW



There have been five unique periods of mass extinction when major events such as asteroid strikes and volcanic eruptions caused many species to go extinct over a relatively short period of time. Some scientists think we are currently in the sixth mass extinction event, caused by human activity.

The high arctic camel, now extinct, once lived in North America.



Source: Adobe Stock; Daniel Eskridge

- 2 **The invention of farming.** In part because there were no longer enough big animals to eat, humans started farming about 12,000 years ago. Farming has changed the Earth in many ways, including through deforestation. Forests were burned to clear the land for crops. The growing of crops created greenhouse gases that gradually warmed the planet.

DID YOU  
KNOW



The invention of farming and the transition away from a hunter-gatherer lifestyle has contributed to the increase in human population. Ten thousand years ago, there were five million people. In 2022, the human population reached eight billion. This increase in population is due in part to the mass production of food, which makes it possible to sustain a large population.



Source: Adobe Stock; Valentin Valkov

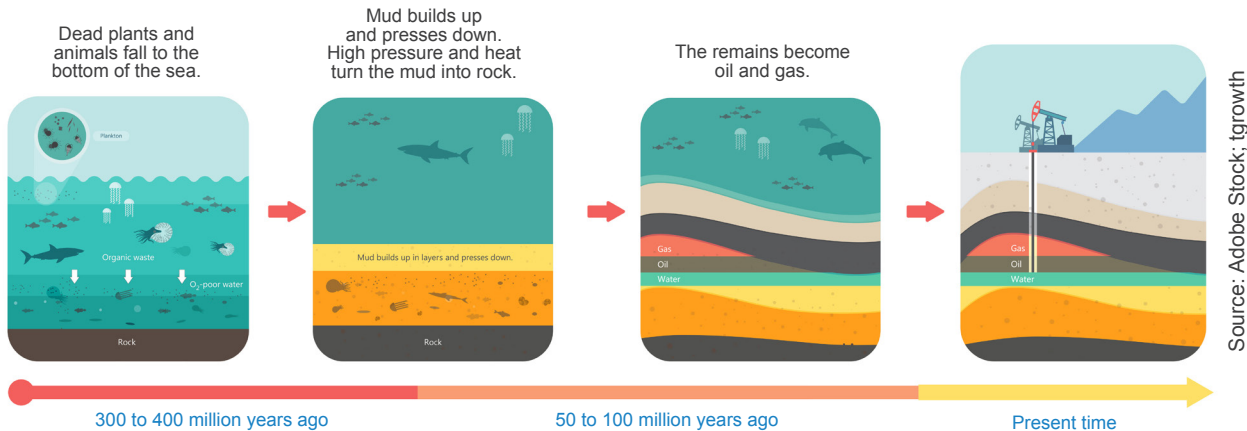
- 3 The discovery of fossil fuels.** Fossil fuels form deep within the Earth and include coal, oil, and natural gas. It takes millions of years for fossil fuels to form. The discovery of fossil fuels contributed to the Industrial Revolution. Today, the world runs on oil, coal, and gas, which are used for heating, lighting, and transportation. The carbon dioxide that is produced from burning fossil fuels is changing the environment. Temperatures are getting warmer, which is causing changes to weather patterns and rising sea levels. Climate change affects water supply, biodiversity, and ecosystems. For more information about these topics, see First Book's Climate Change in the U.S. and A Future Without Waste and The LEGO Group's Build the Change Course Packs: Biodiversity and Climate Change and A Future Without Waste.

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Fossil fuels are currently used to supply 80 percent of the world's energy.

#### Oil and Gas Resources



- 4 The production and use of modern materials.** Plastic is now used frequently and widely, and it is hard to imagine life without it. Humans have created 8 billion tons of plastic since it was invented in the 1950s. Plastic is not biodegradable, which means it remains all around us — in the land, in the oceans, and in the air.

DID YOU  
KNOW

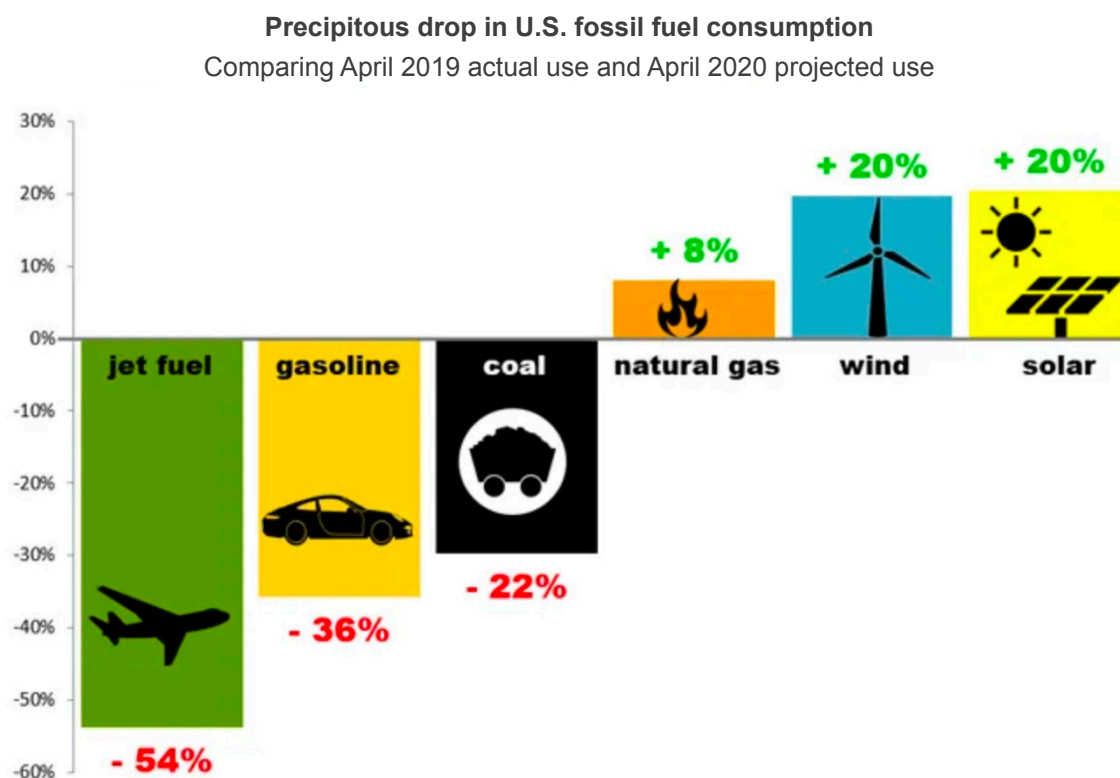


Between Hawaii and California, there is a “plastic island” known as the Great Pacific Garbage Patch, which is around 617,763 square miles. This “island” is formed from plastic and other litter from boats and land, the result of the improper disposal of plastic items. The majority of the waste is single-use plastics like polystyrene containers and plastic fishing gear like buoys, nets, and lines.



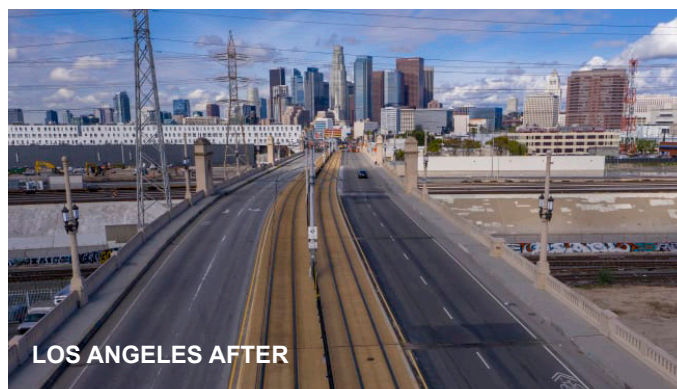
## Human Impact During the Pandemic

One way to visualize the effects of people and their daily activities on the environment is by looking at how the pandemic affected human habits and behavior and how those changes affected the environment. During quarantine, people reduced their fossil fuel use for transportation, construction, and production. During quarantine, people reduced their fossil fuel use for transportation, construction, and production.



Data from the U.S. Energy Information Administration. Graphic by Karin Kirk for Yale Climate Connections.  
Source: "Coronavirus pandemic leads to profound cutbacks in fossil fuel use." Yale Climate Connections, 2020.

Some regions of the world that usually experience smog and air pollution looked different after many people stopped traveling or commuting to work, and factories stopped or reduced production. These before and after photos of Los Angeles show the impact of humans on their environment.



Source: "Before and After: The Environmental Impact Of COVID-19 in Cities." Travel.Earth, 2020.

## Human Impact: For Better and for Worse

Most types of human activity have both positive and negative impacts on society and the planet.

Human Intervention/ Invention	Advantages	Disadvantages	What People Are Doing to Help
Advances in medicine	People are living longer, healthier lives overall.	More people on the planet means more consumption and waste.	<ul style="list-style-type: none"> <li>• Buying less</li> <li>• Recycling</li> <li>• Reusing</li> </ul>
Agriculture	The food supply can feed more people.	Large industrial farms are hurting the environment through water use, soil erosion, and the creation of methane from cattle.	<ul style="list-style-type: none"> <li>• Buying locally grown food</li> <li>• Planting community gardens</li> <li>• Visiting farmer's markets</li> <li>• Reducing meat consumption</li> </ul>
Deforestation	We use wood for many purposes, including construction.	Cutting down trees reduces oxygen levels, increases greenhouse gases, causes soil erosion, and destroys animal habitats. Increases in greenhouse gases also contribute to global warming.	<ul style="list-style-type: none"> <li>• <u>Reforestation</u> – approximately 40% of the trees that are cut down are replaced through replanting</li> <li>• Protecting endangered species by creating preserves and sanctuaries</li> </ul>
New materials such as plastic	Plastic allows us to create products that are lightweight, durable, and strong. Plastic is also cheap to produce.	Most modern plastics are derived from nonrenewable resources like petroleum. Recycling plastic is expensive, and single-use plastics are quickly discarded and end up as waste. Plastic that is improperly disposed of is the main source of ocean pollution. Plastic waste can harm the environment and human health.	<ul style="list-style-type: none"> <li>• Supporting local and federal environmental protection laws to keep plastic and harmful chemicals out of our land and water</li> <li>• Reducing the use of single-use plastic</li> <li>• Recycling</li> </ul>
Discovery of and use of fossil fuels	Fossil fuels are used for energy, transportation, and in the production of plastic, steel, concrete, and other important materials.	The use of fossil fuels damages the ozone layer and causes climate change. Fossil fuels are a <u>nonrenewable resource</u> .	<ul style="list-style-type: none"> <li>• Exploring alternative energy sources like wind and solar</li> <li>• Designing electric and hybrid cars</li> </ul>


The National Science Teaching Association (NSTA) standards state, “Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes (MS-ESS3-4).” Scientists can provide evidence and data about the effects of human activity on the planet, but this information does not provide a solution to the problem. People — such as policy makers, scientists, and concerned citizens — must consider the data as well as the best interests of communities when proposing solutions.

# PART II: SKILLS PRACTICE

## Videos & Discussion Questions About Human Impact

Have students watch the following three *Above the Noise* videos from PBS Learning Media. Each video has accompanying discussion questions and activities.

**Pre-watching activity:** For each video, give students a KWL Chart so they can write down what they know about the topic, what they want to know, and what they learned after watching.



**1**

**Watch** ▶

**Watch the Video:**  
Is Your Sunscreen Hurting Coral Reefs?

### Discussion Questions

- What does the data and other evidence tell us about how sunscreen affects coral reefs?
- How could different people come to different conclusions, policies, and proposed solutions based on the same evidence that was presented in the video?
- What questions do you still have about the topic?
- How do you think we should protect our coral reefs from sunscreen?



**2**

**Watch** ▶

**Watch the Video:**  
Is a Carbon Tax the Best Way to Slow Climate Change?

### Discussion Questions

- How is a carbon tax related to climate change?
- What are arguments in favor of a carbon tax?
- What are arguments against a carbon tax?
- How would a carbon tax affect big businesses, small businesses, and ordinary families?
- Would you support a carbon tax?
- What other ideas do you have to reduce our production of greenhouse gases?

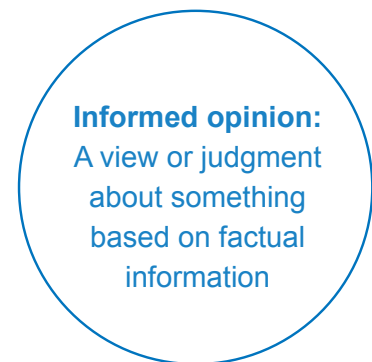
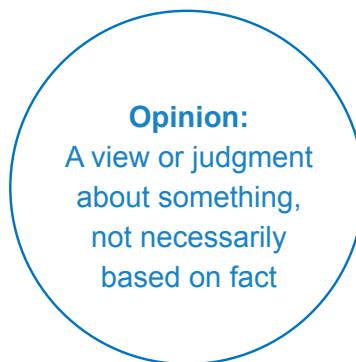
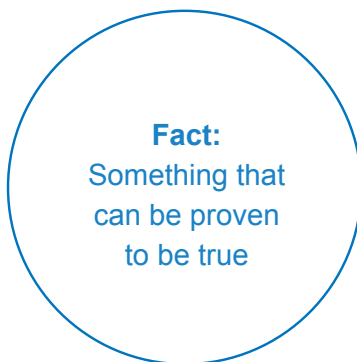


### Discussion Questions

- What are some of the reasons that species become extinct?
- What are different ways that people can protect endangered species?
- What does the term “ecosystem services” mean?
- How do ecosystem services relate to the issue of protecting individual species from extinction?

## Facts vs. Opinions

Review these definitions with students:



Hand out the Facts/Opinions Worksheet and have students watch the videos again. As they listen, ask them to list three facts and three opinions from each video.

*Examples from the Endangered Species: Worth Saving from Extinction?*

### Facts:

- The pygmy hippo is endangered.
- The pygmy hippo lives in Africa.
- There are only two or three thousand pygmy hippos left in the wild.

### Opinions:

- We owe it to our grandchildren to preserve species so they can also see them in the wild.
- The pygmy hippo is too stinking cute.
- Pygmy hippos are cuter than salamanders.

## Human Impact Research Project

### OPTION A

Have students research an area of human impact and present both the relevant scientific data and their informed opinion about possible solutions. Students can create a slideshow, video, poster, or article. Their projects should include a graph, chart, or images to identify patterns in data (MS-ESS3-2).

Topics like “pollution” or “fossil fuels” may be too big to tackle. Suggest students drill down until they find a manageable subtopic. For example, instead of just “pollution,” students could focus on “air quality in cities” or “oil spills.” Instead of “dependence on fossil fuels,” students could focus on alternate forms of transportation (e.g., walking or biking) or alternate sources of electricity (e.g., solar and wind).

Students should include the following information about their topic:

- **Facts:** Where in the country or world is this practice or issue happening? When did this practice or issue start? What does the data show about how it is harming and/or helping the environment and people?
- **Existing solutions:** What solutions have been tried to offset the problem or issue?
- **Informed opinion:** What solution do you propose for how to solve or address the problem?
- **Taking action:** How could your class or program become involved and contribute to the solution?





California Condor;  
Adobe Stock



Florida Manatee;  
Adobe Stock; Nicolas Larento



Red Wolf, displaying brown fur  
in its environment;  
Adobe Stock; Rejean Aline

## OPTION B

Animal species are becoming extinct at increasingly alarming rates. There are many factors when considering whether and how to protect a species from extinction, including moral and ethical arguments and biological and economic reasons. For example, it can be expensive to protect a habitat and protecting habitats also limits economic opportunities like development for businesses.

Have students choose a specific threatened or endangered species to research. Examples of species in the U.S. include the red wolf, the Florida panther, the Florida manatee, the Loggerhead sea turtle, the Mississippi gopher frog, and the California condor. Have students use Canva, Piktochart, or Google Drawings to create an infographic with facts about the animal, how and why it is threatened, if they think the animal should be protected, and, if so, ways to protect it.

Students should include the following information about their topic:

- **Facts:** Where does this species live? What role does it play in its ecosystem? Why is it endangered?
- **Solutions:** What steps have already been taken to protect this species?
- **Informed opinion:** Do you think this species should be protected? If so, why? What steps would you take to protect this species from extinction?
- **Taking action:** How could your class or program become involved and contribute to protecting this species?

### What is an infographic?

An infographic is a visual representation of data that uses minimal text and features like pie charts and graphs to convey information.

# APPENDIX

NATIONAL SCIENCE TEACHING ASSOCIATION STANDARDS

KWL WORKSHEET

FACTS & OPINIONS WORKSHEET

DEFINITIONS

SOURCES

## NATIONAL SCIENCE TEACHING ASSOCIATION (NSTA) HUMAN IMPACT STANDARDS

**The National Science Teaching Association (NSTA) lists the following performance expectations for middle school students related to human impact:**

Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. MS-ESS3-2

Apply scientific principles to design a method for monitoring and minimizing human impact on the environment. MSESS3-3

Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's system. MS-ESS3-4

### Disciplinary Core Ideas:

Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. MS-ESS3-3

Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. MS-ESS3-3, MS-ESS3-4

### Crosscutting Concepts:

Graphs, charts, and images can be used to identify patterns in data. MS-ESS3-2

Source: "Middle School: Human Impacts Standards." NSTA - National Science Teaching Association, 2022.

BEHIND THE NOISE KWL WORKSHEET

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Video Title: \_\_\_\_\_

KWL Chart

What I Know	What I Want to Know	What I Have Learned



## FACTS & OPINIONS WORKSHEET

### Is Your Sunscreen Hurting Coral Reefs?

#### *Facts*

- 1.
- 2.
- 3.

#### *Opinions*

- 1.
- 2.
- 3.

### Is a Carbon Tax the Best Way to Slow Climate Change?

#### *Facts*

- 1.
- 2.
- 3.

#### *Opinions*

- 1.
- 2.
- 3.

### Endangered Species? Worth Saving from Extinction?

#### *Facts*

- 1.
- 2.
- 3.

#### *Opinions*

- 1.
- 2.
- 3.

## DEFINITIONS

The **Anthropocene Epoch** is a unit of time that describes the most recent period on Earth. During this time, human activity started to have a major impact on the planet's climate and ecosystems.

**Biodegradable** refers to a substance or object that can be decomposed, or broken down, by bacteria or other living organisms.

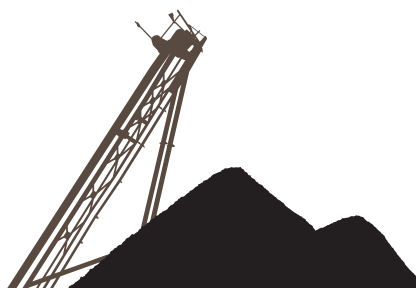
**Deforestation** is the act of clearing a wide area by cutting down trees. Throughout history, people have cut down forests to make space for farming and to use wood for fuel, manufacturing, and construction.

An **ecosystem** is a natural environment and includes the plants and animals that live in and interact with that environment.

**Ecosystem services** are the collective benefits we get from ecosystems. Healthy, diverse ecosystems provide clean air, food, and water. Each species in an ecosystem plays a role, and if one species dies out, it can affect the entire ecosystem. We need insects to pollinate our crops and decomposers (such as fungi) to get rid of waste.

An **endangered species** is a species in danger of extinction throughout all of or a significant part of its range or habitat. An endangered species is close to becoming extinct.

**Extinction** refers to the dying out of a species. Mass extinction is widespread and there is currently a rapid decrease in the number of species. The last mass extinction was about 65 million years ago when dinosaurs lived on Earth.



**Fossil Fuels** are materials that form deep within the Earth, including coal, oil, and natural gas. These resources are used for electricity, heating, and in transportation. It takes millions of years to create fossil fuels. Dead plants and animals become trapped in layers of rock. Heat and pressure change this material into fuel.

**The Industrial Revolution** was a major change in industry that took place in parts of Europe



and the U.S. in the late 18th century. During this period, the manufacturing of goods moved from small shops and homes to large factories. Producing items in large quantities, often in factories, is called mass production. This change in where jobs were available caused many people to move from rural areas to big cities.

**Megafauna** are large mammals of a particular region, habitat, or geological period.

**Nonrenewable resources** are resources that cannot be immediately replaced after they are used. Examples include coal, petroleum, and natural gas.

**Reforestation** is the process of replanting an area with trees.



A **threatened species** is at less risk than an endangered species and may bounce back without direct human intervention.

# SOURCES

[An Evolutionary Timeline of Homo Sapiens | Science | Smithsonian Magazine](#)

[Anthropocene | National Geographic Society](#)

[Coronavirus Pandemic Leads to Profound Cutbacks in Fossil Fuel Use | Yale Climate Connections](#)

[Discussions: Are Endangered Species Worth Saving? | KQED Learn](#)

[Endangered Species: Worth Saving from Extinction? | Above the Noise | PBS LearningMedia](#)

[Extinction | National Geographic Society](#)

[Biodiversity | Our World in Data](#)

[Five Ways Humans Have Re-shaped Planet Earth | The Earthbound Report](#)

[Human Evolution Interactive Timeline | The Smithsonian Institution's Human Origins Program \(si.edu\)](#)

[Is a Carbon Tax the Best Way to Slow Climate Change? | Above the Noise | PBS LearningMedia](#)

[The Development of Agriculture | National Geographic Society](#)

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