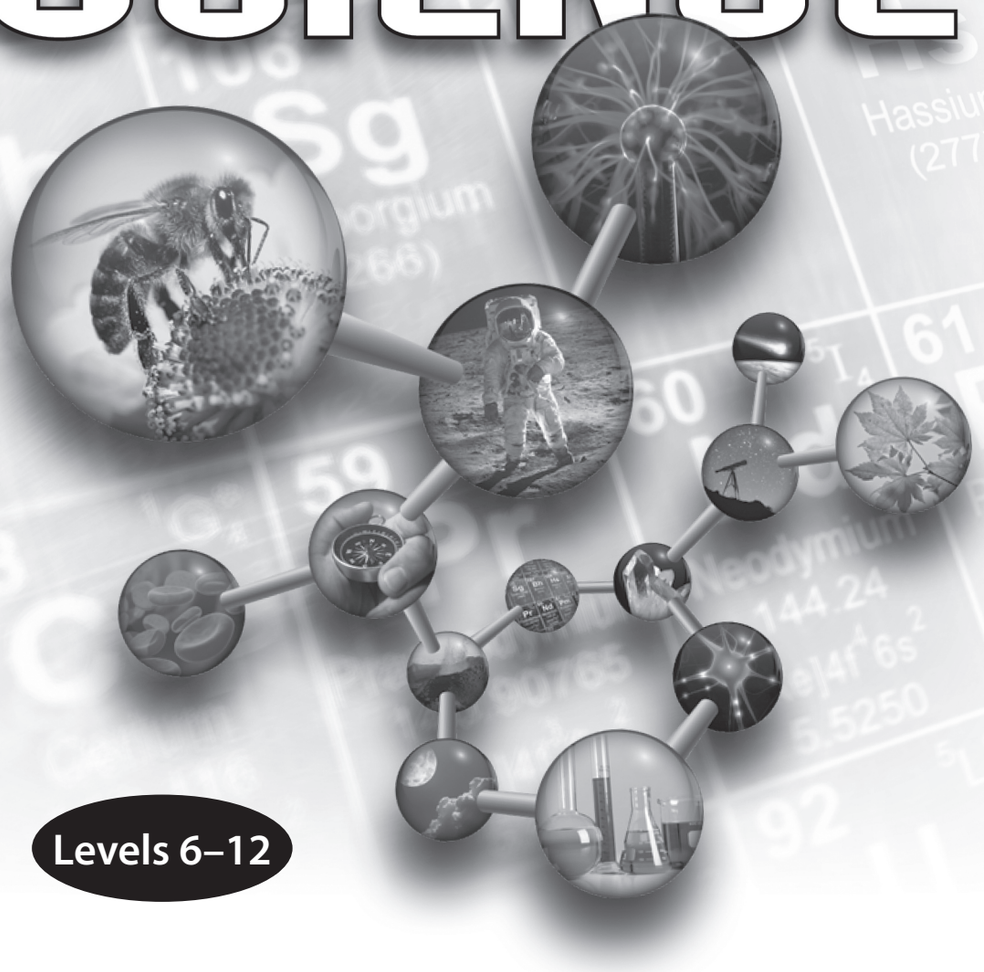
Strategies for Teaching SCIENCE



Levels 6–12

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SHELL EDUCATION

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Save the Panda! Save . . . the American Burying Beetle?

Grades 6–8 Lesson

Standard

Students will know factors that affect the number and types of organisms an ecosystem can support (e.g., available resources; abiotic factors such as quantity of light and water, range of temperatures, and soil composition; disease; competition from other organisms within the ecosystem; predation).

Vocabulary

- abiotic
- consumer
- diversity
- ecosystem
- endangered
- habitat
- producer
- scavenger
- threatened

Materials

- *Protecting the Species* activity sheets (pages 79–82)
- chart paper *(optional)*

Procedure

1. Distribute copies of the *Protecting the Species* activity sheets to students. Explain that human populations and activities are threatening Earth's habitats and capacity to sustain life. Read aloud the passage on the activity sheet or have students read it silently to themselves.
2. After they have finished reading, have students work with partners to answer the discussion questions on their activity sheets (questions 1–7).
3. Ask students to share their responses. Encourage students to give details that they know about the topic. Have them explain why they feel that endangered species should or should not be protected. If possible, on chart paper, make a list of animals and plants they know are endangered. (This may be heavily dependent upon the area in which students live.)
4. Tell students that the panda bear is endangered for several reasons: its habitat has shrunk, it has a small population, and it only lives in a small geographic area. On their activity sheets (question 8), have students list reasons why the panda should be considered endangered or not.

Save the Panda! Save . . . the American Burying Beetle? *(cont.)*

Procedure *(cont.)*

5. Have students define the vocabulary words on their activity sheets (question 9). Explain that there is a government agency dedicated to protecting the environment for humans, plants, and animals across the United States (EPA) as well as international organizations dedicated to protecting animals. Have students revisit questions 1–7 on their activity sheets and determine what new understandings have been gained.
6. Introduce the topic of environmental diversity, organisms that are producers or consumers, and animals that are scavengers. Have students add the qualities of each part of an ecosystem to the chart (question 10) on their activity sheets.
7. Display the passage on *Beetle Habitats* from the activity sheet or have a student read it aloud. Ask students to answer questions 11–13, and follow up with a brief discussion.
8. As an extension, separate the class into three groups of students: one group will advocate for the American burying beetle; the other group will advocate for human interests; the last group will be the policymakers. Have students debate the pros and cons of protecting the burying beetle, and have the policymakers decide the fate of the beetle based on the arguments presented. Students can then write a short essay about their positions.
9. Conclude the lesson by discussing the difficulties governments have in deciding which species to protect and determining how much money to spend for its protection.

Differentiation

Above-Level Learners

Have students explore more of the EPA website and learn more about the topic of endangered species and conservation.

Below-Level Learners

Have discussions and organize the debate using smaller groups. This will give students an opportunity to share their ideas in a more comfortable environment and to listen and understand others' viewpoints.

English Language Learners

Provide pictures of the American burying beetle. Find out what large animals are endangered in the home countries of English language learners and refer to them throughout the lesson.

Name _____

Protecting the Species

DIRECTIONS Read the following passage. Then answer the questions below.

Endangered!

Population experts forecast that the human population may reach 8.5 billion in 2025, up from 5.2 billion in 1990. Plant and animal species are disappearing faster than at any other time in the last 65 million years. Habitat loss accounts for almost 75 percent of the extinctions occurring now. It is important to be aware of current environmental policies and issues and of the underlying science that helps form those policies.

Policies or laws that help save endangered species help preserve life, but can also have a negative effect on humans. Laws can be costly to pass and to implement. For example, companies that want to build a large factory or shopping mall might not be able to do so because it would destroy beetle habitat. A new road or apartment building could bring in more night lighting that harms the beetle.

One of the other challenges in gaining support for protecting endangered and threatened species is that many such species are small, unattractive, or unknown.

1. Is the world a safe place for all animals and plants? Why or why not? _____

_____

2. What does it mean for a species to be endangered? What animal or plant species do you know of that are endangered? _____

_____

3. Why do you think some species are endangered? _____

_____

4. How do you feel about this ongoing global problem? What, if anything, happens when an animal or plant species becomes extinct?

_____

_____

_____

Protecting the Species *(cont.)*

5. How do you think this situation can be realistically improved? Should it be improved?

_____

_____

_____

6. Should all endangered species be protected? Why or why not? _____

_____

_____

7. Are human concerns and problems more important than those of animals? _____

_____

_____

8. In the chart below, list at least three reasons why the panda should or should not be considered an endangered species.

The panda should be considered endangered because…	The panda should not be considered endangered because…

Protecting the Species *(cont.)*

9. Define the following vocabulary terms:

- abiotic: _____
- consumer: _____
- diversity: _____
- ecosystem: _____
- endangered: _____
- habitat: _____
- producer: _____
- scavenger: _____
- threatened: _____

10. In the chart below, list at least three characteristics or three examples of each part of an ecosystem.

Producer	Consumer	Scavenger

Name _____

Protecting the Species *(cont.)*

DIRECTIONS Read the passage, then answer the questions below.

Beetle Habitats

American burying beetles are master scavengers, cleaning the environment as they bury small dead mammals and insects for future consumption. Currently, American burying beetle sightings have occurred in Nebraska, Rhode Island, Oklahoma, and Arkansas. This animal was officially listed as a federal endangered species in 1989.

American burying beetle populations began a decline during the 1920s. The decline is due to several factors. Fragmentation of habitat has increased accessibility for other carrion consumers such as fox, raccoon, small mammals, and some raptors. Thus, the American burying beetle often finds less and less to bury and then eat. Another reason is the increased lighting in developed areas. This diminishes the abundance of night use for insects and displaces food sources for the beetles. Also, certain genetic changes may alter reproduction on some level (Michigan DNR 2007).

11. List three reasons why the beetle is endangered:

_____

_____

_____

12. What might happen if there were no more burying beetles in the United States?

_____

_____

Is it important to save something like a tiny beetle that eats the same food as foxes, raccoons, other small mammals, and some large birds? _____

_____

13. List three abiotic factors in an environment that might contribute to endangering a species._____

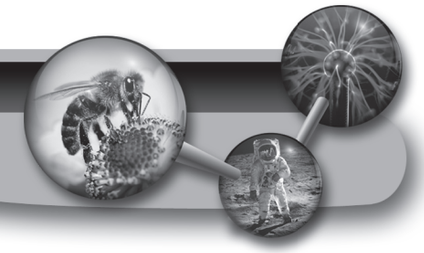
_____

_____

_____

Global Warming and Extinction

Grades 9–12 Lesson



Standard

Students will know ways in which humans can alter the equilibrium of ecosystems, causing potentially irreversible effects (e.g., human population growth, technology, and consumption; human destruction of habitats through direct harvesting, pollution, and atmospheric changes).

Materials

- *Population Growth* activity sheets (pages 85–88)
- chart paper *(optional)*

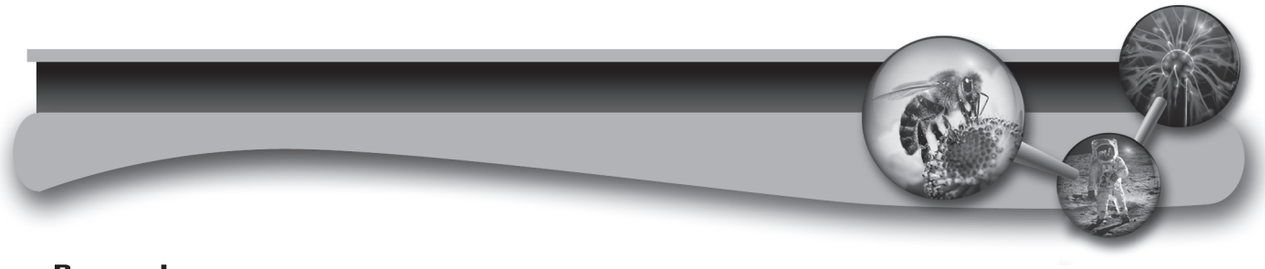
Vocabulary

- carbon dioxide
- coral reefs
- fossil fuels
- global warming

Procedure

1. Explain to students that they will learn how human population growth threatens species worldwide. Distribute copies of the *Population Growth* activity sheets to students. Have students read the passage "Threats to the Environment," and then work with partners to answer questions 1 and 2 on their activity sheets.
2. Ask students to discuss their answers with the class. Accept all responses, including references to the idea that it is "junk science" and not supported by the evidence. Allow students to discuss what they consider to be the biggest threats to humans or other living things. Compile a list of responses on the board or on chart paper.
3. Have students read about the warming ocean temperatures (page 86). On their activity sheets, have students refer to the EPA chart in order to answer questions 3 and 4.
4. Have students read the passage called "Coral Reefs" on their activity sheets and then answer questions 5–6. Ask students to share their ideas about the role of coral reefs in the ocean ecosystem.
5. Have students share their lists of three or four global consequences if large numbers of coral reefs die.

Global Warming and Extinction *(cont.)*



Procedure *(cont.)*

6. Direct students to read the final passage on their activity sheets, "Atmospheric Carbon Dioxide," and answer questions 7–9. Have them choose a controversial issue to research and present a reasoned argument for or against a specific action to take on the issue.
7. Assess student responses based upon their use of scientific information, the practicality of implementing personal changes in use of fossil fuels and energy, and the picture of life in a more crowded, warmer world.

Differentiation

Above-Level Learners

Assign specific topics for students to further research about global warming. Assign a focus on one part of an ecosystem (e.g., polar ice caps, changing seasons, increasing ocean temperatures, species extinction) and speculate about how it might be affected by global warming. Instead of a written report, assign a poster project with short descriptions of energy alternatives or anticipated changes due to global warming.

Below-Level Learners

Give students alternative choices for how to share information about their own personal energy consumption. Instead of writing a paper, allow students to choose a different format to convey their ideas.

English Language Learners

Review vocabulary for this lesson and discuss relevant terms and ideas. Ask students to share their prior knowledge of global warming and discuss what they know in small groups.

Name _____

Population Growth

DIRECTIONS Read the passage and then answer the questions below.

Threats to the Environment

There are many ways in which human population growth threatens species worldwide. The kinds of activities that threaten the environment (e.g., habitat destruction, human disturbance, garbage, and global warming) are directly related to the increase in humans and their use of resources. These changes in Earth's life systems cause imbalances, triggering dangerous environmental changes in the landscapes, oceans, and atmosphere of the world. The U.S. Census Bureau projects a world population of 8 billion by 2025, an increase of nearly 20 percent more people than the 2008 population. Because of the increased pressure from more people trying to use the same amount of resources, the effects upon Earth's environments may be catastrophic.

1. What do you know about global warming? _____

_____

_____

_____

_____

_____

_____

2. If global warming is occurring and is a threat to the environment, what kinds of living things do you think will be affected the most? _____

_____

_____

_____

_____

_____

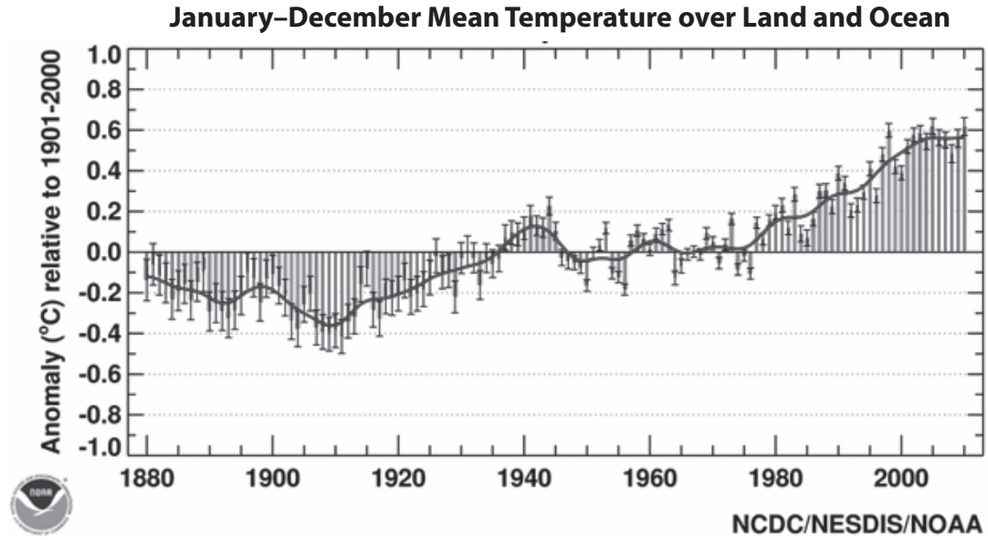
_____

Population Growth *(cont.)*

DIRECTIONS Read the passage and study the chart. Then answer the questions that follow.

Scientists have observed many changes that demonstrate that global warming is occurring. Observed effects include the increase in surface temperatures, both on land and in the oceans, sea level rise, shrinking glaciers, changes in the range and distribution of plants and animals, trees blooming earlier, lengthening of growing seasons, ice on rivers and lakes freezing later and breaking up earlier, and thawing of permafrost soil in the Arctic regions. A key issue being studied is how societies and Earth's environment will adapt to or cope with climate change.

Use the U.S. Environmental Protection Agency (EPA) chart shown below to explain some of the most current data regarding surface temperatures from 1880–2006.



From Recent Climate Change: Annual Average Global Surface Temperature Anomalies 1880–2006 (U.S. Environmental Protection Agency Climate Change Website, U.S. EPA 2007)

3. Have mean temperatures risen or fallen between 1880 and 2006? _____

_____

Population Growth *(cont.)*

4. In the list below, write whether the effect listed is due to temperature changes on *land*, in the *oceans*, or *either* on land or in the ocean.

_____sea level rise

_____shrinking glaciers

_____changes in the range and distribution of plants and animals

_____trees blooming earlier

_____lengthening of growing seasons

_____ice on rivers

_____lakes freezing later and breaking up earlier

_____thawing of permafrost

Read the following passage and then answer the questions below.

Coral Reefs

Despite covering less than 0.2 percent of the total area of oceans, coral reefs are noted for some of the highest levels of total productivity on Earth. They house 25 percent of all marine species. While growing, corals absorb large amounts of carbon from the ocean and from the atmosphere to create the calcium carbonate that makes up their exoskeleton. All corals are animals, but like lichens on land, which are part fungi and part algae, they have a symbiotic relationship with algae.

5. What role do coral reefs play in the ocean ecosystem? _____

_____

6. If increasing ocean temperatures kill off large numbers of coral, how will that affect the amount of carbon dioxide in the atmosphere, which is a key cause of global warming? List at least three possible consequences. _____

_____

_____

Population Growth *(cont.)*

DIRECTIONS Read the following passage and then answer the questions below.

Atmospheric Carbon Dioxide

Scientific research has shown that Earth's current cycle of global warming is faster and more severe than at any other time in the planet's history. Research has also pinpointed that most of the cause is due to human activity. According to the United States Environmental Protection Agency:

> In the U.S., our energy-related activities account for three-quarters of our human-generated greenhouse gas emissions, mostly in the form of carbon dioxide emissions from burning fossil fuels. More than half the energy-related emissions come from large stationary sources such as power plants, while about a third comes from transportation. Industrial processes (such as the production of cement, steel, and aluminum), agriculture, forestry, other land use, and waste management are also important sources of greenhouse gas emissions in the United States. (EPA 2008)

7. How does your own personal energy consumption affect the amount of carbon dioxide in the atmosphere? _____

_____

8. Describe what you personally could do to reduce the use of fossil fuels, and what the general public and governments could do to reduce the public's dependence upon fossil fuels, given current technologies. _____

_____

_____

9. Speculate what your adult life might be like if the world's population increases past 8 billion, the coral reefs die off, and global warming is still increasing. _____

_____

