- One of the effects of global warming is a rise in air temperature, and this will cause continental glaciers to melt faster, putting more water into the oceans and causing sea levels to rise. The short-term effect of higher sea levels will be felt by those living in coastal communities, who will experience stronger storm surges associated with tropical storms, but a longer-term problem will be faced by small island nations around the world. Ask students to research the case of the small nation of Tuvalu in the South Pacific. Students should locate Tuvalu on a world map, research its natural surroundings and analyze concerns about its future. As a follow-up, students may identify and map other island nations, such as the Maldives, that may be equally vulnerable to rising sea levels in the future. Students may also convene a mock U.N. discussion designed to highlight the interests and concerns of the leaders of threatened island countries. Valuable research material may be found at the following web sites: **yosemite.epa.gov/oar/globalwarming.nsf/content/ClimateFutureClimateSeaLevel.html**, **icesat.gsfc.nasa.gov/climatechange.html**
- Somewhere between 70 and 75% of the planet's surface is covered by water, and thanks to the water cycle, it is roughly the same water supply that Earth had billions of years ago. Ask students to develop charts that indicate where Earth's water is located and in what forms it exists. How much of Earth's water is available for our use? As a follow-up, ask students to research and report on local water resources and the agencies responsible for protecting their own watershed. Great sources of background information may be found at the following web sites: **ga.water.usgs.gov/edu/earthhowmuch.html**, **www.acnatsci.org/education/river/page1.html**
- Plate tectonics emerged as an idea based on the superficial concept that the shapes of continents would fit well if they were pushed together. Ask students to research the evolution of plate tectonic theory and analyze evidence for continental drift and underlying plate tectonics. Students may create a plate tectonic map of Earth, evaluate fossil comparisons on the edges of continents, indicate seismic or volcanic activity along plate boundaries and identify mountain ranges formed where plates are pushing together. More information on plate tectonics may be found at the following web site: **www.ucmp.berkeley.edu/geology/tectonics.html**

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Suggested Internet Resources

Periodically, Internet Resources are updated on our web site at www.LibraryVideo.com

- **www.ipcc.ch/**
  The Intergovernmental Panel on Climate Change assesses the potential impacts of climate change and provides options for potentially mitigating this major global issue.
- **memory.loc.gov/ammem/afctshtml/tshome.html**
  The Library of Congress provides "Voices from the Dust Bowl," valuable oral histories and photographs of residents living in migrant work camps in California during the Great Depression.
- **www.fs.fed.us/gpnf/volcanocams/msh/**
  The USDA Forest Service's "Mount St. Helens VolcanoCam" offers a live image from the Johnston Ridge Observatory along with information on current conditions provided by the Mount St. Helens National Volcanic Monument.

Suggested Print Resources

- Batten, Mary. *Aliens from Earth: When Animals and Plants Invade Other Ecosystems*. Peachtree, Atlanta, GA; 2003.
- Fridell, Ron. *Global Warming*. Franklin Watts, New York, NY; 2002.
- McKinney, Barbara Shaw. *A Drop around the World*. Dawn Publications, Nevada City, CA; 2004.

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Geography for Students

PHYSICAL SYSTEMS

Grades 5–9

The study of geography brings together various dimensions of Earth, so that we can increase our knowledge of both the physical and human processes that shape the planet. Enhancing geographic literacy with an in-depth analysis of the spatial aspects of human existence provides students with insight into some of the most challenging questions facing Earth. As world population surges past the six billion mark, as globalization intensifies social and economic interconnections and as the physical environment becomes more and more threatened, *Geography for Students* offers students a unique opportunity to grasp their increasingly complex world and gain a better understanding of their place in it.

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Program Summary

While we exert an influence over our planet, the surface of the Earth is constantly being modified and reshaped by geologic forces, such as volcanic activity and earthquakes, and physical processes, such as weather and erosion. Our planet's four main physical systems — the atmosphere, lithosphere, hydrosphere and biosphere — are distinct systems, but they are all interconnected and what happens in one system can have vast repercussions on the others. Earth's ecosystems maintain a natural balance within their own boundaries, but this stability can be altered by both human forces, such as mismanagement of natural resources and physical forces, such as floods or droughts. Additional physical changes such as the Earth heating up, sea levels rising and tropical storms increasing in strength have been linked to global warming. Learning to understand our planet's systems gives us insight into the dynamic and constantly changing nature of an awesome and powerful world.

Vocabulary

atmosphere — A layer of gases — mostly nitrogen and oxygen — that surrounds Earth and provides the conditions that are favorable for sustaining life.

lithosphere — The outermost shell of Earth, including the crust and the upper part of the mantle.

hydrosphere — The collective mass of water found on, under and over the surface of Earth.

biosphere — The part of Earth where living organisms such as plants, animals, insects and people are found.

ecosystem — A place where communities of living things interact with each other and with nonliving components, such as soil and water.

The Dust Bowl — The calamitous soil erosion caused by the removal of grasslands and by severe droughts that ruined many farms and farmers in the Great Plains in the 1930s.

El Niño — The periodic warming of ocean water in the eastern Pacific Ocean, which affects natural ecosystems and human-built environments.

Zebra Mussel — An exotic, invasive species of mussel inadvertently brought to the United States by European ships, which wreaks havoc on freshwater ecosystems.

tectonic — A term that refers to the structure or movements of Earth's crust, which is divided into twelve major "tectonic plates."

greenhouse gas — Molecules in Earth's atmosphere that absorb energy from the sun and warm Earth's surface. Important greenhouse gases include carbon dioxide, water vapor and methane. Human activities increase the amount of these gases and are thought to contribute to global warming.

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global warming — An accelerated increase in the surface temperature of Earth. The best scientific explanation for this phenomenon is the buildup of greenhouse gases, such as carbon dioxide, due to human activity.

fossil fuels — Energy resources such as coal, oil or natural gas that are created within the earth from the remains of plants and animals of millions of years ago.

nonrenewable resources — Materials that are in limited supply or take a very long time to form, such as fossil fuels like coal, oil or natural gas.

renewable resources — Materials that can be replenished and are readily available for use, such as sunlight, water, air, soil, plants and animals.

San Andreas Fault — A geological fault line that extends along roughly 800 miles of California coast and is the source of many serious earthquakes.

Pre-viewing Discussion

- Discuss how people have had an impact on the physical systems of Earth. Provide examples of how Earth's physical processes have sculpted our planet in beautiful and unique ways.
- What are natural resources? Can you provide some examples? Do you think all natural resources are going to be available for use on Earth forever?
- Ask students to discuss a personal experience related to an environmental issue, such as air or water pollution, or a natural disaster, such as a hurricane or flood.

Focus Questions

1. What are the four main physical systems on Earth?
2. How did the eruption of Mount St. Helens affect physical systems in Washington and other areas?
3. What is an ecosystem? Provide examples.
4. In what ways do people impact the balance of production and consumption within an ecosystem?
5. What was the Dust Bowl?
6. How does the El Niño phenomenon impact Earth's ecosystems?
7. What is an invasive species? Why are they considered one of the greatest threats to an ecosystem?
8. When is a system said to be in a state of equilibrium?
9. How fast do tectonic plates move?
10. What is considered the driving force that fuels all of the physical processes on Earth?
11. Why is global warming considered to be a symptom of a much larger problem?

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12. How are fossil fuels created?
13. What are renewable resources? Provide examples.

Follow-up Discussion

- Compare how the natural environment recovers from a natural disturbance to the way it responds to the pressures and influences of human beings.
- More and more people in the United States are deciding to live near fault lines or along coastlines. Describe the risks associated with these decisions and discuss the relative risks involved with living in various parts of the world.
- Analyze the connection between people, plants, animals, insects and other living organisms in an ecosystem.

Follow-up Activities

- Sunlight is one of Earth's greatest natural resources and is considered the driving force that fuels all of the physical processes on Earth. The sun is Earth's main source of energy, but we use many other renewable and nonrenewable resources on a daily basis. Ask students to maintain a "Natural Resources Log" that records all of the natural resources that they use over the course of a week. After the log is completed, ask students to share their entries with the rest of the class. As a follow-up, students may brainstorm and chart a variety of ways to conserve these resources at home and at school.
- The Earth's wetlands are important components of the water cycle that provide a buffer between the open ocean and the mainland, and are environments where unique plants and animals reside. Ask students to research the awesome, yet fragile, Mississippi River Delta, an area that is disappearing at a rapid rate. Over 1,000 square miles of Louisiana have disintegrated in the past half-century, contributing to the vulnerability of the city of New Orleans during Hurricane Katrina. Break students into research teams and ask each group to create maps of the region, summarize the causes of wetland destruction, identify species that have been lost from the coastal wetlands system, and develop proposals to encourage restoration of this threatened landscape. More information may be found at the following web site:
  coastal.er.usgs.gov/gc-subsidence/pdf.html

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