

# NATIONAL GEOGRAPHIC EDUCATOR'S GUIDE

NEXT GENERATION SCIENCE ALIGNMENTS



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# EXTREME WEATHER



## Instructional Note

The Next Generation Science Standards (NGSS) are built on the Core Disciplinary Ideas (CDIs) of the Framework for K-12 Science Education. In this Educator's Guide, activities introduce, review, or otherwise address one or more of the CDIs used as the basis for the NGSS performance expectations for each grade level.

# Grade 2

**ESS1.C:** *The History of Planet Earth* Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

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**ESS2.A:** *Earth Materials and Systems* Wind and water can change the shape of the land.

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## MATERIALS

- 1 rectangular, disposable cake pan per group
- 6-12 cups potting soil per group
- 1 paper cup per group
- 2-3 books for stacking per group
- Water
- Optional: Wax paper or other protective covering for desks
- Optional: 1 digital camera per group

## FAST-FLOWING WATER

Read aloud Chapter 5, “Downpours and Floods.” As you read, pause to discuss the text, the photos, and the relationship between the two.

After reading, ask students what both downpours and floods have in common (fast-moving water that can cause serious damage). Ask students to share ideas about why and how fast moving water can cause damage to the land. Record students’ responses.

Divide students into small groups. Take students to a place where dirty water won’t cause a mess, or have students cover their desks or tables with wax paper.

Show students the provided materials, and invite them to design an investigation to explore the effect of water on soil. Before beginning their investigation, remind students to record the materials they will use, the steps they will take, and what they expect will happen.

If more support is needed, encourage students to create an incline with the pan, fill it with dirt, and pour water down the incline at different speeds.

Give students time to conduct their investigation. Remind them to record their results and observations. If you wish, give students access to digital cameras to photograph each attempt.

When students have concluded their investigations, regroup as a class. Invite groups to share their results and observations. If needed, prompt students to realize that the faster water flows, the more damage to land it can cause.

Invite students to think about how their investigation is similar to what can happen during a downpour or flood. If you wish, have students write a short response.

# Grade 3

**ESS2.D: Weather and Climate** Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

Climate describes a range of an area’s typical weather conditions and the extent to which those conditions vary over years.



## MATERIALS

- Weather reports
- Access to research resources, such as the Internet

## HOT AND COLD

Read aloud Chapter 1, “Heat Waves and Cold Waves.” As you read, pause to discuss the text, the photos, and the relationship between the two.

After reading, ask students to share ideas about why heat waves and cold waves can be so dangerous. If needed, prompt students to consider what would happen if an area is unprepared for extended and extreme heat or cold, beyond the area’s normal climate.

Divide students into pairs or small groups. Invite each group to choose an area to investigate, such as your state or region. Have students find the following information for their region:

- Average summer temperature
- Average fall temperature
- Average winter temperature
- Average spring temperature
- Average difference in temperature (difference between average high and average low)
- Has the region had a heat wave or cold wave in the past year? 5 years? 10 years?
- If so, what was the average temperature during the wave?
- How did the wave affect people living in the region? What accommodations did they need to make?
- What problems did the wave cause?

Invite students to use the information they have gathered to create a safety awareness brochure for their region. Students should include information about the region’s usual climate, past heat or cold waves, and ways people can stay safe.

## Grade 4

**ESS3.B: Natural Hazards** A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

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### MATERIALS

- Art supplies, including poster board
- 1 digital video camera per group

### BE PREPARED

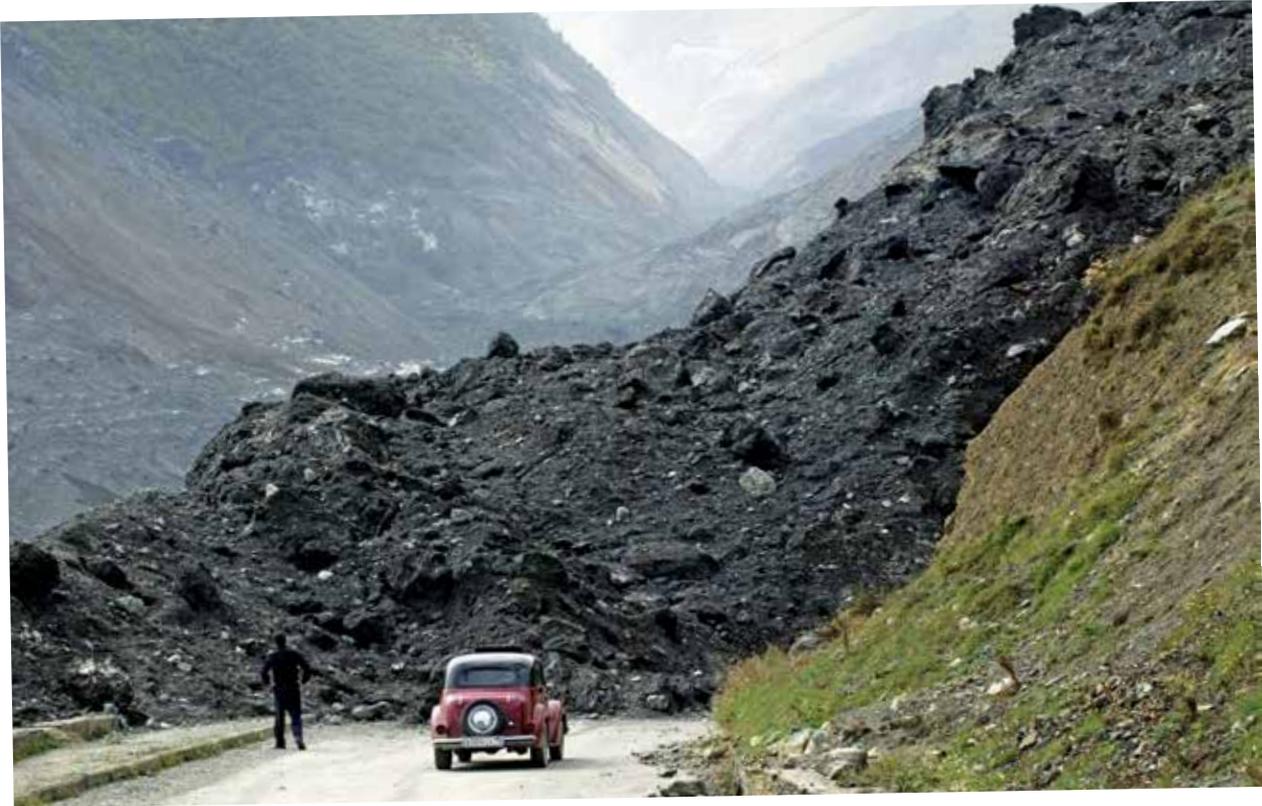
Invite students to read Chapter 6, “Hurricanes, Tornadoes, and Waterspouts,” in pairs, small groups, or individually. As students read, encourage them to pause to discuss the text, the photos, and the relationship between the two.

After reading, ask students to share ideas about why each of these natural hazards can be so dangerous. If needed, prompt students to consider what happens when a natural hazard happens without much warning.

Invite students to turn to the **Before, During, After** chart on page 95. As a class, read the chart together. Discuss the precautions people can take at different stages of a natural disaster. Then turn to the **Before, During, After** charts on pages 101 and 107. Ask students to identify similarities among the charts. If needed, point out that the **Before** sections involve watching for signs, removing potential hazards, and having a plan; the **During** sections emphasize finding safety; and the **After** sections recommend listening to authorities and checking carefully before venturing out or returning home.

Divide students into groups. Tell groups that their job is to write and film a Public Service Announcement about preparing for a natural hazard. Students can choose from a hazard in the book or other natural hazard. Remind students that their PSA should include information about what to do before, during, and after the hazard. They should include specific, useful tips and information about the hazard.

Give students time to write their scripts, create props, and film their PSA. Then share the videos with the class, with parents, or with other classes. Invite students to lead a discussion with the audience about preparing for hazards.



## Grade 5

**ESS3.C: Human Impacts on Earth Systems** Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

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### MATERIALS

- Art supplies, such as papier-mâché

### MUDSLIDE MODEL

Invite students to read the mudslides part of Chapter 4 (pages 70-75) in pairs, small groups, or individually. As students read, encourage them to pause to discuss the text, the photos, and the relationship between the two.

After students have finished reading, point out that the text mentions that human actions can have an effect on mudslides, but doesn't go into details. Invite students to share ideas about what human actions the text might be referring to, and how those actions could have effects. If needed, prompt students to think about what happens when humans pull up plants on steep hills, carve into land to create roads, etc.

Invite students to create a model showing before-and-after effects of human action on landforms vulnerable to mudslides. Encourage students to be creative in designing their models. For example, students might want to create papier-mâché mountains that show before-and-after deforestation.

Give students time to plan, gather materials for, and create their models. Then have students display their models around the classroom. Invite students to present and explain their models, and lead a discussion about what each shows about human actions on the environment.

## Middle School

**ESS3.D: Global Climate Change** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities.

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### MATERIALS

- Access to research resources, such as the Internet

### BE PREPARED

Invite students to read the wildfires part of Chapter 2 (pages 30-35) in pairs, small groups, or individually. As students read, encourage them to pause to discuss the text, the photos, and the relationship between the two.

After students finish reading and discussing, have students turn to page 32. Read aloud the last paragraph, emphasizing the last sentence. Ask students to share ideas about how our warming planet might be contributing to the frequency and intensity of wildfires.

Tell students to imagine that, due to increased wildfires in their area, their local government is about to vote on a new law to reduce greenhouse gas emissions. The class has been invited to speak to a group of voters to encourage them to support the law. To prepare their speeches, invite students to do further research into the issue. Encourage students to find reliable, appropriate sources. If needed, review with students which sources would provide such information and how to spot facts vs. opinions.

When students have finished their research, give them time to prepare their speeches. Then invite students to present their speeches to the class, another class, or another audience.

# STANDARDS

## Grade 2

**ESS2.B: Plate Tectonics and Large-Scale System Interactions** Maps show where things are located. One can map the shapes and kinds of land and water in any area.

**ESS2.C: The Roles of Water in Earth's Surface Processes** Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

## Grade 3

**ESS3.B: Natural Hazards** A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

## Grade 4

**ESS2.A: Earth Materials and Systems** Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

## Grade 5

**ESS2.A: Earth Materials and Systems** Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

**ESS2.C: The Roles of Water in Earth's Surface Processes** Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

## Middle School

**ESS2.C: The Roles of Water in Earth's Surface Processes** Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.

**ESS2.C: The Roles of Water in Earth's Surface Processes** Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as down-hill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity.

**ESS2.C: The Roles of Water in Earth's Surface Processes** The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.

**ESS2.D: Weather and Climate** Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. Because these patterns are so complex, weather can only be predicted probabilistically. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.