Science & Literacy Activity

GRADES 3-5

OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to natural hazards. Students will read content-rich texts, visit *Nature's Fury: The Science of Natural Disasters*, and use what they have learned to complete a CCSS-aligned writing task by creating a text about predicting natural hazards.

Materials in this packet include:

- Teacher instructions for:
  - o Pre-visit student reading
  - o Visit to *Nature's Fury* and Student Worksheet
  - o Post-visit writing task
- Text for student reading: "Spinning Thunderstorms"
- Foldable Graphic Organizer for *Nature's Fury* visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

Common Core State Standards:
CCSS.ELA-Literacy: RI.3-5.1, RI.3-5.2, RI.3-5.4, RI.3-5.10, W.3-5.2, W.3-5.8

New York State Science Core Curriculum:
2.1e

Next Generation Science Standards:

- Disciplinary Core Idea ESS3.B: Natural Hazards. A variety of natural hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions, severe weather, floods, coastal erosion). Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
- Science and Engineering Practice 8: Obtaining, Evaluating and Communicating Information

SUPPORTS FOR DIVERSE LEARNERS: An Overview

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It represents information in multiple ways and offers multiple ways for your students to engage with content as they read about, discuss, view, and write about scientific concepts. Different parts of the experience (e.g. reading texts, locating information in the exhibition) may challenge individual students. However, the arc of learning is designed to offer varied opportunities to learn. We suggest that all learners experience each activity, even if challenging. We have provided ways to adapt each step of the activities for students with different skill-levels. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

1. BEFORE YOUR VISIT

This part of the activity engages students in reading a non-fiction text about forecasting a natural disaster. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Before reading, conduct a vocabulary clustering activity to introduce some potentially unfamiliar words that students will encounter in the text: tornado, forecast, meteorologist, radar precipitation, radio wave (feel free to add your own). When introducing the word, write it on chart paper and circle it (students can also do this on their own or in small groups). Ask students what the words make them think of. Write student associations or definitions of the word around it, grouping similar ideas together. Keep these word clusters available throughout the rest of this activity for reference.

Have students read "Spinning Thunderstorms." Ask them to write notes in the large right-hand margin. For example, they could underline key passages, paraphrase important information, or write down any questions. They may also use this space for drawings or diagrams of the processes that are described.

Ask:

- What is a tornado?
  (A swirling column of very fast wind that forms in a thunderstorm and reaches the ground.)
- Under what conditions do tornadoes form?
  (Tornadoes form in thunderstorms when warm wet air meets cool dry air.)
- Where in the United States do tornadoes happen the most often?
  ("Tornado Alley" is located in the middle of the United States, in the Great Plains.)

• How does radar help scientists forecast tornadoes?
(Radar uses radio waves that bounce off of precipitation in storms to recognize the swirling pattern that the winds of a tornado make. These signals also help them determine in what direction the tornado is moving, and how fast.)

Students can work in pairs, small groups, or as a class. During discussion, remind them to use evidence from the text to explain their thinking, and to use specific examples.

Distribute the Foldable Graphic Organizers and have students fold along the dotted lines to create a booklet with the title "*Nature's Fury: The Science of Natural Disasters*" on the front and the "tornadoes" page visible when they open it up. Have them fill in the appropriate information on the "tornadoes" page using the information from the article, leaving space to add information during their visit to the exhibition.

SUPPORTS FOR DIVERSE LEARNERS: Student Reading
- The first two paragraphs of this reading briefly describe a devastating tornado that took place in the recent past, and mentions the human death toll and extensive damage that it caused. Very sensitive students may find this content upsetting; if you feel that this may be the case, skip the first two paragraphs and conduct the activity with the rest of the reading.
- "Chunking" the reading can help keep students from becoming overwhelmed by the length of the text. Present them with only a few sentences or a single paragraph to read and discuss before moving on to the next "chunk."
- Provide "wait-time" for students after you ask a question. This will allow time for students to search for textual evidence or to formulate their answers more clearly before they speak.

2. DURING YOUR VISIT

This part of the activity engages students in exploring the *Nature's Fury* exhibition.

Museum Visit & Student Worksheet
Explain to students that they will be walking through the major sections of the exhibition that focus on earthquakes, volcanoes, tornadoes, and hurricanes, and using the same Foldable Graphic Organizer to take notes on how scientists study natural hazards. Tell students that back in the classroom they will refer to these notes when completing the writing assignment.

SUPPORTS FOR DIVERSE LEARNERS: Museum Visit
- Review the Foldable Graphic Organizer with students, clarifying what information they should collect during the visit.
- Have students explore the exhibition in pairs, with each student completing their own Graphic Organizer.
- Encourage student pairs to ask you or their peers for help locating information. Tell students they may not share answers with other pairs, but they may point each other to places in the exhibition where answers are located.

3. BACK IN THE CLASSROOM

This part of the activity engages students in an informational writing task that draws on the pre-visit reading and on observations made at the Museum.

Writing Task
Distribute the Student Writing Guidelines handout, which includes the following prompt for the writing task:

> Based on your reading, your visit to the *Nature's Fury* exhibition, and your discussions, write an essay in which you describe how scientists study natural hazards such as earthquakes, volcanoes, hurricanes, or tornadoes. Include examples of the kinds of information that scientists collect when they study each of these hazards.
>
> Support your discussion with evidence from the reading and your visit to *Nature's Fury*.

Go over the handout with students. Tell them that they will use it while writing, and afterwards, to evaluate and revise their essays.

Before they begin to write, have students use the prompt and guidelines to frame a discussion around the information that they gathered in *Nature's Fury*, and compare their findings. They can work in pairs, small groups, or as a class. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading and their exhibition notes that can be used in their response to the prompt. Instruct each student to take notes on useful information that their peers gathered as they compare findings. Students should write their essays individually.

SUPPORTS FOR DIVERSE LEARNERS: Writing Task

- Re-read the "Before Your Visit" assignment with students. Ask what they saw in the *Nature's Fury* exhibition that helps them understand how people forecast or prepare for natural hazards.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

Student Reading

Spinning Thunderstorms

On a spring night in 2007, disaster struck a small town in Kansas called Greensburg. Shortly before 10 p.m., a siren went off. A mile-wide tornado was approaching Greensburg. And it wasn't just any tornado. It was a category EF5, the most powerful kind there is.

© AMNH

A tornado is a swirling, funnel-shaped column of wind.

Its winds were estimated to be more than 200 miles per hour. In less than ten minutes, the town was destroyed and ten people lost their lives.

When the fury had passed, people clambered through the rubble. Cars and trucks had been thrown about. Homes were crushed, or simply ripped from the ground. "I'm in downtown Greensburg. There's really nothing left," said one resident.

© FEMA/M. Raphael

The tornado destroyed much of the town. Many residents needed temporary housing.

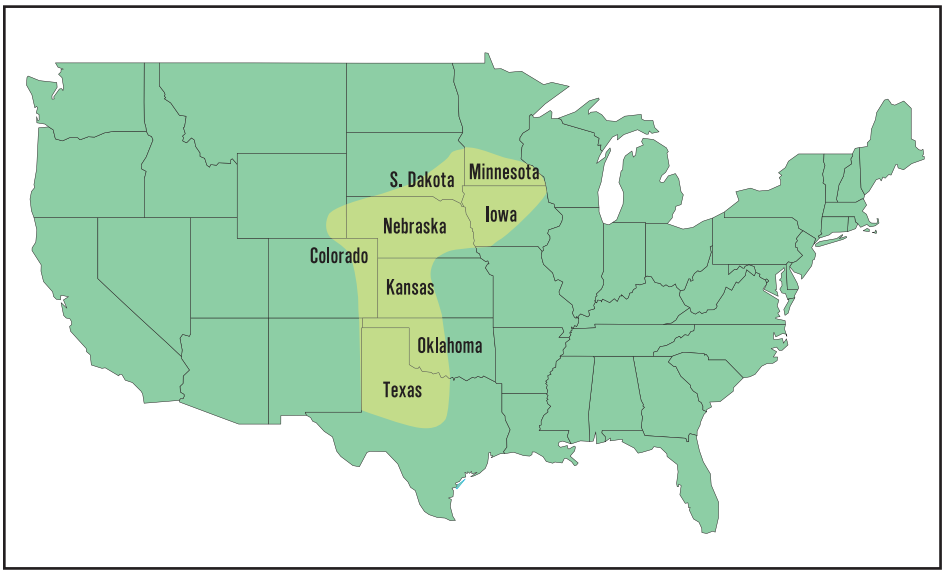
© The Field Museum

The 200-plus-mph winds of a tornado can bend a stop sign.

How do tornadoes form?

A tornado is a swirling, funnel-shaped column of wind that gets its start from a thunderstorm. Thunderclouds form when warm, wet air collides with cool, dry air. Then, strong winds form into a wide tube of spinning air. When the tube touches the ground, it becomes a tornado.

Kansans are used to tornadoes. The people of Greensburg live smack in the middle of "Tornado Alley," an area that spans eight states in the central United States. This region is a perfect thunderstorm factory. It has just what storms need to get started: cool, dry air from the Arctic mixing with warm, humid air from the Gulf of Mexico. Above the flat Great Plains, far from mountains and coastal weather, thunderstorms can form undisturbed. These conditions spawn more than 600 tornadoes, on average, in the U.S. every year.



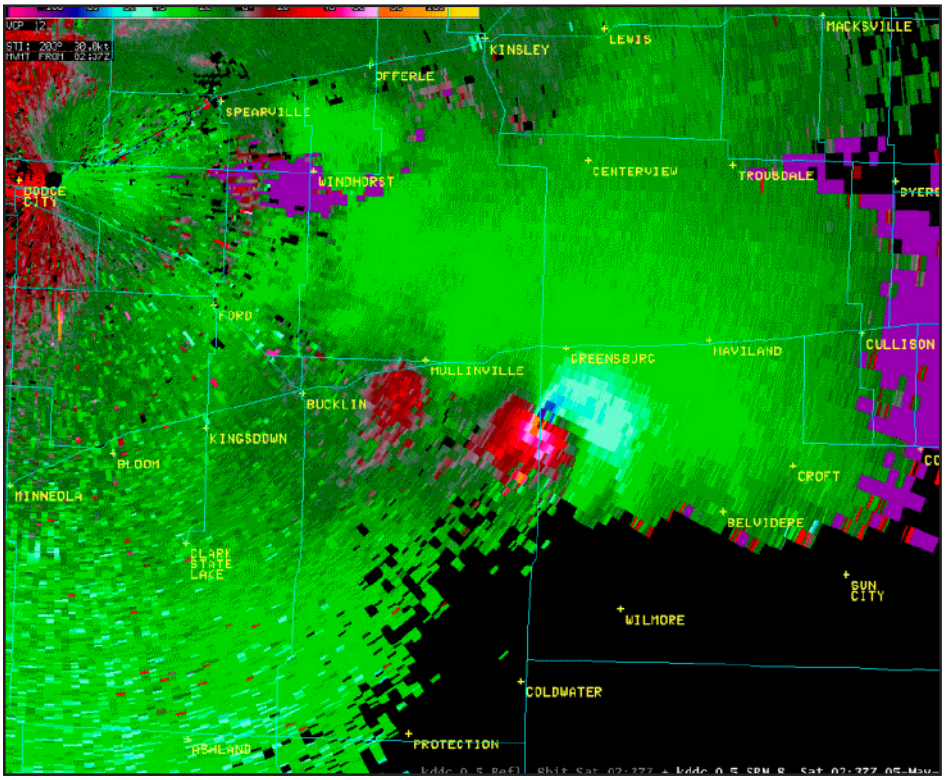
More than 75% of all tornadoes in the world take place in "Tornado Alley."

How do scientists predict dangerous storms?

Meteorologists are scientists who study and forecast weather. They use a technology called radar to track storms. Weather radar works by detecting the precipitation (rain, snow, or hail) in approaching storms. The radar unit sends out a radio wave towards the storm. The radio wave bounces off the raindrops, hail, or snow that is in the storm, and then returns to the radar unit. The amount of time it takes for the wave to return tells meteorologists how far away the storm is. Most radar units send out about 1,000 radio waves per second. This gives them detailed, up-to-the-minute information about the storm.

Using radar, forecasters can track the formation and path of severe storms like tornadoes. When a tornado takes shape, its winds blow raindrops in a circular pattern. When scientists see that pattern on a radar screen, they know that a tornado is developing. Although tornadoes have fast swirling winds, tornadoes themselves move

relatively slowly across the land (18 to 30 miles per hour). So their paths can be predicted with reasonable confidence. A system of tornado watches and warnings are used to alert the public to danger. A tornado "watch" means thunderstorm conditions exist that could spawn tornadoes. A "warning" means a tornado has touched down and been spotted.



© NOAA

This doppler radar map shows the area around Greensburg right before the tornado stuck. The red and pink areas indicate higher precipitation than the green areas. It also shows rotation and changing wind directions within a small area. Based on this data, meteorologists were able to identify the tornado.

This system saved many lives in Greensburg. After the tornado sirens shrieked, people had 20 minutes to escape to their basements and storm shelters before the tornado destroyed their town.

TORNADOES

Record information about how scientists study tornadoes:

Record information about a particular tornado in history.

Where:

When:

What did scientists observe?

FOLD

FOLD

American Museum of Natural History

My notes for

Nature's Fury
The Science of Natural Disasters

Name:

EARTHQUAKES

Record information about how scientists study earthquakes:

Record information about a particular earthquake in history:

Where:

When:

What did scientists observe?

VOLCANOES

Record information about how scientists study volcanoes:

Record information about a particular volcanic eruption in history:

Where:

When:

What did scientists observe?

HURRICANES

Record information about how scientists study hurricanes:

Record information about a particular hurricane in history:

Where:

When:

What did scientists observe?

TORNADOES

Record any information you about on how scientists study tornadoes:

(Answers may include: Scientists use radar to identify a tornado as it forms and determine how far away it is and the direction it is moving [from reading]. They use weather radios to broadcast this information to keep people safe. Probes that are placed in a tornado's path can record information about wind speeds and show images of the storm from the inside, where it is too dangerous for a person to be.)

Record the following information about a particular tornado in history.

Where: *(Sample answer: Greensburg, Kansas)*

When: *(May 4, 2007)*

What did scientists observe?

(Cars were overturned and buildings were destroyed [from reading]. From the damage, scientists determined that this tornado should be rated as a T5, which is the most damaging tornado type [from exhibition].)

FOLD

FOLD

American Museum of Natural History

My notes for

Nature's Fury:
The Science of Natural Disasters

Name:

_____

ANSWER KEY

EARTHQUAKES

Record information about how scientists study earthquakes:

(Answers may include: Scientists use tools called seismometers to measure the strength of earthquakes. They place seismometers all over the world so that they can measure all the earthquakes that happen. They also record all earthquakes that happen on maps to detect patterns that show where they are most likely to occur in the future.)

Record information about a particular earthquake in history:

Where: *(Sample answer: San Francisco)*

When: *(1902)*

What did scientists observe?

(Rifts, or cracks, opened in the ground, buildings toppled, fires started in the damaged areas)

VOLCANOES

Record information about how scientists study volcanoes:

(Answers may include: For clues to what's going on underneath a volcano, scientists study the shape of the volcano, and the lava, gasses, and other materials that come out of it or are found near its surface. Scientists also use seismometers to study volcanoes, since earthquakes can happen just before or or during an eruption. They also monitor the volcano with radar to see if it changes shape, which can also mean it will erupt.)

Record information about a particular volcanic eruption in history:

Where: *(Sample answer: Mt. Pelée, Martinique)*

When: *(May 8, 1902)*

What did scientists observe?

(A glowing cloud of hot gasses came out of the volcano as it erupted, destroying the nearby town of St. Pierre. There were also earthquakes, a tsunami, and mudslides associated with the eruption.)

HURRICANES

Record information about how scientists study hurricanes:

(Answers many include: Scientists look at many satellite images over time to figure out the storm's path. Like in studying tornadoes, they also use Doppler radar to measure the storm's wind speed and direction from far away. A tool called an anemometer can measure wind speeds inside the storm. To study hurricanes and big storms in history, scientists can look at tree rings—the rings that form in years that more hurricanes happen are different from those in years when there are fewer.)

Record information about a particular hurricane in history:

Where: *(Sample answer: New York City)*

When: *(October 22-23, 2012)*

What did scientists observe?

(Severe flooding from a surge in ocean water resulted in power outages and widespread damages.)

Student Writing Guidelines

Writing Prompt:

Based on your reading, your visit to the *Nature's Fury* exhibition, and your discussions, write an essay in which you describe how scientists study natural hazards such as earthquakes, volcanoes, hurricanes, or tornadoes. Include examples of the kinds of information that scientists collect when they study each of these hazards.

Support your essay with evidence from the reading and your visit to the exhibition.

Use this checklist to ensure that you have included all of the required elements in your essay.

- ☐ I introduced the topic of studying natural hazards.
- ☐ I clearly named four natural hazards and described the kinds of information scientists collect about them.
- ☐ All of the information I presented is relevant to how scientists study natural hazards.
- ☐ I used information from "Spinning Thunderstorms" to explain how scientists study natural hazards in detail.
- ☐ I used information from the *Nature's Fury* exhibition to explain how scientists study natural hazards in detail.
- ☐ I included a conclusion at the end.
- ☐ I proofread my essay for grammar and spelling errors.

Assessment Rubric

	Scoring Elements	1 Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
RESEARCH	**Reading**	Attempts to include text using examples, quotes, or other references.	Presents some information from reading materials but may lack accuracy or relevance.	Accurately presents information from reading materials relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from reading materials to inform or explain.
	AMNH Exhibition	Attempts to include Museum exhibit content using examples, quotes, or other references.	Presents some information from Museum exhibit but may lack accuracy or relevance.	Accurately presents information from Museum exhibit relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from Museum exhibit to inform or explain.
WRITING	**Focus**	Attempts to address the prompt, but is off-task.	Addresses the prompt, but focus is uneven.	Addresses the prompt with an adequately detailed response; stays on task.	Addresses key aspects of prompt in a detailed response; stays on task.
	Development	Attempts to inform or explain but lacks details.	Informs or explains by presenting some details.	Informs or explains using appropriate details.	Informs or explains by providing detailed and relevant information.
	Conventions	Lacks cohesion and control of grammar, usage, and mechanics appropriate to grade level	Demonstrates an uneven command of standard English conventions appropriate to grade level.	Demonstrates a command of standard English conventions, with few errors as appropriate to grade level.	Maintains a well-developed command of standard English conventions, with few errors. Response includes language and tone appropriate to the purpose and specific requirements of the prompt.
SCIENCE	**Content Understanding**	Content is irrelevant, inappropriate, or inaccurate.	Shows uneven understanding of disciplinary content related to the topic.	Presents generally accurate disciplinary content related to the topic.	Presents accurate and relevant disciplinary content to enhance understanding of the topic.