

Natural Disasters in Japan

Subject: Science

Grade Level: 7th and 8th Grade (Middle School)

Topic: Earth's system/activities, Natural Disasters

Summary: Students will understand the earth's system and activities by researching natural disasters that have occurred in Japan (earthquake, tsunami, flood, and typhoon). Japan is the top exposed country to natural disasters among developed countries. Students will develop research, analytical, and communication skills and creativity through researching/studying the scientific mechanism of one of the natural disasters that occurred in Japan in the past. Moreover, students will research how the disaster impacted Japan including people's lives and how Japan is trying to mitigate the negative impact of the disaster. Finally, students will identify who is highly vulnerable during natural disasters, such as women and people with disabilities, and why they are highly affected by the disaster. This lesson plan allows students to apply their scientific knowledge to thinking of a solution to improve the issue.

Learning Goal:

Students will

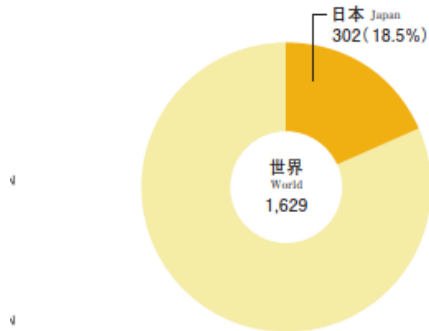
- acquire skills to analyze various data by researching the impact of natural disasters that have occurred in Japan
- develop communication and creativity skills through presenting the scientific mechanism of the disaster
- understand how science helps to prevent the negative impacts of natural disasters on people's lives
- broaden their focus to include vulnerable populations during natural disasters
- apply scientific knowledge to mitigate the vulnerability of certain communities during natural disasters.

Key Facts

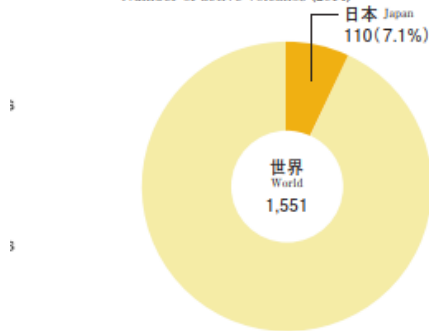
- Japan is the top exposed country to natural disasters among developed countries. Therefore, Japan has adopted various disaster prevention measures to respond with natural disasters, such as regular evacuation drills and integrating earthquake-resistant structures into buildings and infrastructure

The ratio of Natural Disasters in Japan to Those in of the World

マグニチュード6.0以上の
地震回数 (2004年～2013年)
Number of earthquakes with magnitude of
6.0 or greater (2004-2013)



活火山数 (2014年現在)
Number of active volcanos (2014)



出典: 防災白書 Source: White Paper on Disaster Management

- Plates move relative to one another. Slip-on faults that define the plate boundaries commonly results in **earthquakes**.
- **Tsunamis** are large, potentially deadly and destructive sea waves, most of which are formed as a result of submarine earthquakes. They can also result from the eruption or collapse of an island or coastal volcanoes and from giant landslides on marine margins. Note that 72% of tsunamis are generated by earthquakes.

- **A tropical cyclone**, also called typhoon or hurricane, an intense circular storm that originates over warm tropical oceans and is characterized by low atmospheric pressure, high winds, and heavy rain.
- Scientists estimate 20 **volcanoes** worldwide are erupting on the land on any particular day. Still more are probably erupting underwater, but scientists don't have enough instruments to detect them. Many of these submarine eruptions theoretically occur along mid-ocean ridges, where an estimated 80 percent of Earth's magma erupts unnoticed.
- People with disabilities and the elderly and women are in many ways especially vulnerable to the safety and health hazards of natural disasters and have specific needs in emergencies.

Relevant Curriculum Unit:

- **DCPS** <Next Generation Science Standard>:
 - 4.Earth's Systems: Processes that Shape the Earth
Students who demonstrate understanding can:
 - ✓ 4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
 - ✓ 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
 - ✓ 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
 - ✓ 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
 - MS. Human Impacts
Students who demonstrate understanding can:
 - ✓ MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
 - ✓ MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
 - ✓ MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

➤ HS. Human Sustainability

Students who demonstrate understanding can:

- ✓ HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

● **FCPS** <Science Standards of Learning>:

➤ Earth Science

ES.7 The student will investigate and understand that plate tectonic theory explains Earth's internal and external geologic processes. Key ideas include

- a) convection currents in Earth's interior lead to the movement of plates and influence the distribution of materials in Earth's layers, and may impact the magnetic field;
- b) features and processes occur within plates and at plate boundaries;
- c) interaction between tectonic plates causes the development of mountain ranges and ocean basins; and
- d) evidence of geologic processes is found in Virginia's geologic landscape.

ES.10 The student will investigate and understand that oceans are complex, dynamic systems and are subject to long- and short-term variations.

Key ideas include

- a) chemical, biological, and physical changes affect the oceans;
- b) environmental and geologic occurrences affect ocean dynamics;
- c) unevenly distributed heat in the oceans drives much of Earth's weather;
- d) features of the sea floor reflect tectonic and other geological processes; and
- e) human actions, including economic and public policy issues, affect oceans and the coastal zone including the Chesapeake Bay.

ES.12 The student will investigate and understand that Earth's weather and climate are the result of the interaction of the sun's energy with the atmosphere, oceans, and the land. Key ideas include

- a) weather involves the reflection, absorption, storage, and redistribution of energy over short to medium time spans;
- b) weather patterns can be predicted based on changes in current conditions;
- c) extreme imbalances in energy distribution in the oceans, atmosphere, and the land may lead to severe weather conditions;
- d) models based on current conditions are used to predict weather phenomena; and
- e) changes in the atmosphere and the oceans due to natural and human activity affect global climate.

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