

Unit 3 overview

Learning objectives

In this unit, students will

- explain the causes of deadly earthquakes;
- describe and explain the causes of the spatial and temporal distribution of deadly earthquakes through historical times;
- analyze risk factors for a country or region; and
- make predictions about the risk of earthquake hazards by using knowledge of a country's population density, gross domestic product, and historical seismicity.

In the **Exploring plate tectonics** unit, students learned that plate motions are fairly continuous through time and change very slowly. This reason is why geologists think that we can use the past as a key to understanding the future. The concept is especially important when trying to prevent geologic hazards from becoming geologic disasters. Understanding where to look for hazards and how often we can expect them is critical to assessing hazard risk to human life and property damage. It also allows us to develop plans to reduce that risk. In the three hazards activities (Earthquake Hazards, Volcanic Hazards, and Tsunami Hazards), students will come to understand these phenomena better.

In this unit, students will examine historical earthquake data to understand the hazards earthquakes pose for human society and how human society addresses the risks.

Activity 3.1 – The Great Lisbon Earthquake (Engage)

This portion of the unit is designed to help students understand the learning task and make connections to past and present learning experiences. After reading about the Great Lisbon Earthquake, students discuss their thoughts, ideas, and questions about earthquake hazards. They are asked to think about how earthquake hazards can become disasters, and to identify ways to reduce the risk of disaster.

During the classroom discussion, record all students' ideas on an overhead or a large sheet of paper. Encourage them to consider many different factors. Save the list of questions and ideas for later exploration.

Activity 3.2 – Deadly earthquakes (Explore)

The goal of this portion of the activity is to familiarize your students with the data sets and to pique their curiosity. They examine earthquake data to find out where the largest and most damaging earthquakes have occurred. They also look at earthquake casualty data, explore trends in the occurrence of deadly earthquakes throughout history, and examine the different types of hazards earthquakes pose.

There are numerous multimedia files to explore in this section. These files include animated movies and photos from disaster scenes; they are linked to ArcView, so students can explore them within the framework of the GIS.

Students who complete this portion of the activity early should be encouraged to explore some of the questions raised in the Engage discussion.

Activity 3.3 – Seismic hazards (Explain)

In this stage, students are introduced more formally to the science concepts of the lesson. Students learn about the factors that increase earthquake damage, including the intensity of ground shaking, economic factors, and the population density. They are also introduced to the magnitude scale used to describe or measure the size of earthquakes. Finally, they learn about recurrence intervals and how they can be used to understand and predict future risk of disaster. Discuss these concepts with your students to ensure they have a firm understanding before continuing with the activity.

Activity 3.4 - Seismic risk and society (Elaborate)

In the Elaborate stage, students apply what they have learned to a new situation. They test ideas more thoroughly and explore additional relationships. In this case, they examine seismic hazard and society, looking at various factors (population and population density, Gross National Product and historic earthquakes) to assess the overall risk of disaster for China, Japan, Taiwan, Turkey, and the United States. Finally, they will look at the overall wealth distribution of the planet, compare it to earthquake fatality data, and try to explain the inverse relationship.

Evaluating student comprehension

This section is used to provide students with feedback on their understanding of the lesson. Example assessments are provided, but you may wish to develop other, more authentic assessments that are better aligned with your students' interests. You might have students investigate a specific region of high seismic hazard and evaluate the risks, for example. Another approach for assessment is to have your students resolve any unanswered questions from the Engage section of the activity.