



Remote sensing

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity Students consider place-based hazards using remotely sensed data.

Science Standards NGSS:MS-ESS2-2 – Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

- Learning Outcomes**
- Students will assess housing choices based on natural hazard risks.
 - Students will determine the type of data necessary to assess natural hazard risk.

Map URL: <http://esriurl.com/earthgeoinquiry2>

Engage

What does an area prone to landslides look like?

- Click the link above to launch the map.
- When the map opens, there are tan lines that show elevation.
- ? What type of maps include this information? [*Topographic maps include this information.*]
- Click the link in the upper-right corner, Modify Map.
- Click the button, Bookmarks. Select Hills And Mountains.
- ? What do topo lines look like around hills or mountains? [*Hills and mountains look like concentric circles.*]
- Select the bookmark, Steep Hills And Flat Areas.
- ? What is the difference between steep hills and flat areas? [*Close parallel lines show steep hills.*]

Explore

How many people can a landslide impact?

- With the Details button underlined, click the button, Show Contents of Map (Content).
- Check the boxes to the left of the two layer names: Oso Image Before Landslide, Area of interest.
- Select the bookmark, River.
- Zoom and pan around the area, counting the houses.
- ? How many houses were in the area of interest? [*40 homes, although the landslide destroyed 49 homes.*]
- Turn on the layer, Oso Image After Landslide.
- Click the button, Measure. Set the Tooltip (pg. 2) to measure linear distance in miles.
- Measure from the top of the slide to the southern edge of the rubble field.
- ? How far did the hill move? [*It moved .67 miles.*]
- Click the Measure button. Reset to measure Area in Acres.
- Measure the total area that the slide covered.
- ? How far did the slide cover? [*As much as one mile, approximately 260 acres, with 30-70 feet deep of debris.*]

Explain

Could they have seen it coming?

- Other factors contributed to the slide. The area had received twice the normal rain in the prior two weeks.
- Turn off the layer, Oso Image After Landslide.
- Turn on the layer, Hillshade Post Slide.
- ? How does this change the look of the picture? [*The shading helps you see the shape of the valley.*]
- ? Can you find other areas in this stretch of river that failed and slid? Zoom back far enough. [*There are at least three other areas where slides had occurred and debris is visible below the hillside.*]

more ►

Elaborate

What part might the river have played in the slide?

- Faster moving water erodes better than slow-moving water.
- ? On a curve, where is the water moving the fastest? *[It moves most rapidly on the outside of the curve.]*
- ? What does the river look like directly under the hill that failed? *[The foot of the hill is on the outside curve of a bend in the river. The outer water moves the fastest, with the most ability for erosion. The image before the slide shows smaller slides leading down to the river.]*
- Click the button, Basemap. Select Topographic.
- Zoom in to the hillside that failed until you can read the topo lines.
- ? How tall was this hill from the base topo line in the river? *[From the river, it is 640 feet to the top of Whitman Bench. Each topo line is a 40-foot increase.]*

Evaluate

Where is a safer place to live while still staying near the river?

- Now that you can see that this area had slides in the past, look for a place along the river that you think would be safer.
- ? Can you find a place where the hills are less steep and river is not present to erode the hill? Please list distance and direction from the original Oso site in your answer. *[The hill slightly upriver to the east looks like an area free from recent landslides. There are also several areas south of the river where the hills are not as high and the river is not running against the foot of the hills.]*

MEASURE

- At the top of the map, click the Measure button.
- Hover and click the Distance button.
- Click continuously along what you want to measure.
- Double-click to finish.

BOOKMARK

- At the top of the map, click the Bookmarks button.
- Choose your bookmark; the map will take you there.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Log in to your ArcGIS Online organization account and load the Oso Landslide project. Click Add > Search For Layers, and then search for **hillshade** in ArcGIS Online (uncheck Within Map Area).
- Experiment by adding Terrain: Multi-Directional Hillshade and Terrain: Elevation Tinted Hillshade.

TEXT REFERENCES

This GIS map has been cross-referenced to material in the remote sensing sections of chapters from middle-school texts.

- *Earth Science by Glencoe McGraw Hill – Chapter 1*
- *Earth Science by McDougal Littell – Chapter 1*
- *Earth Science by Prentice Hall – Chapter 1*
- *Earth Science by Tarbuck and Lutgens – Chapter 1*