

Name _____

When Nature Strikes: Landslides – Can They Be Predicted?

Background

Mass movements such as landslides are the downhill movements of Earth materials where gravity is the driving force once a stable slope becomes unstable. There are many triggers that cause landslides such as excessive precipitation and earthquakes, but if the angle at which the Earth material resides on the hillside is changed, downhill movement will occur. In this lesson you will be exploring how various Earth materials move with an increase in slope angle, and you will be applying your results to understand why some areas around the United States are more prone to landslides than others.

Lab Question

How does slope angle (angle of repose) determine the stability of a slope of Earth materials?

Hypothesis

(Use the space below to craft a hypothesis related to the above question. Be sure to explain why you are expecting a certain result!)

Materials per lab team

Part 1:

Cafeteria tray
Race track strip (like those used with small toy cars)
Sand (approximately 500 mL)
Angular gravel (less than 10 mm in size) (approximately 500 mL)
Rounded gravel (less than 10 mm in size) (approximately 500 mL)
Spray bottle filled with water
Protractor
Graph paper

Part 2:

Internet access for each student to do research and to use ArcGIS Online (<http://www.arcgis.com>)

Procedure

Part 1:

1. Gather the lab materials.
2. Place the race track strip on the cafeteria tray.
3. Practice using a protractor to gather the data. See Figure 1.

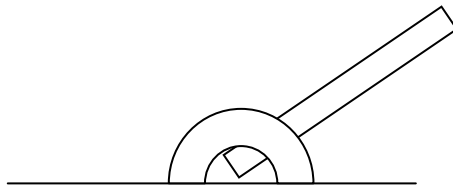


Figure 1: Note the placement of the protractor for collecting angle data.

4. Place approximately 100 mL of the dry sand at one end of the race track while the race track is flat on the cafeteria tray. Slowly raise the end of the track with the sand until a bulk quantity of the aggregate slides down hill. Measure the angle of the race track, and record it in Table 1 below.

5. Repeat the above procedure for the rounded and angular gravel, and record your data in Table 1.

6. Using the spray bottle, dampen approximately 100 mL sand and attempt to make a mountain on the cafeteria tray. The sand should stick together to create a mound. Measure the slope angle as demonstrated in Figure 2. Record your data in Data Table 1.

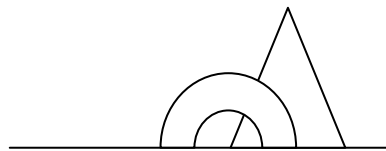


Figure 2: Note the placement of the protractor for collecting angle data.

7. Repeat step 6 using wet sand. Check with your teacher to ensure you are using the correct amount of water. Record your data in Table 1.

8. Clean up your lab station as directed by your teacher. Share your data with the other teams in your class.

Data Table 1:

Earth Material	Slope Angle (°)	Class Average
Dry Sand		
Angular Gravel		
Rounded Gravel		
Damp Sand		
Wet Sand		

9. Using the graph paper, create a bar graph showing Earth materials and class averages. Be sure to include all labels on your graph.

Analysis:

1. Which material made for the steepest slope? _____ Why do you think this is so?
2. How did the water affect the slope angle?

Part 2:

1. Log into ArcGIS Online (<http://www.arcgis.com>). Click on "Map." If you are not familiar with ArcGIS Online, take about 10 minutes to explore program such as zooming in and out, panning, and adding layers. Ask your teacher for assistance if necessary.
2. Click on "Modify Map" in the upper right portion of the page. You will see "Add" in the upper left portion of the page. Click on "Add" and then on "Search for Layers." Search for "U.S. Geological Survey - Landslide Susceptibility," click on "Add" and then "Done Adding Layers." To see the legend to interpret the colors, click on Legend icon in the left column of the page.
3. Explore the layer by zooming in and out and around the country, and by turning the landslide layer on and off. Search for patterns, as well as relationships between the areas in the United States prone to landslides and the topography of the areas.
4. Search for other layers such as the "Aerial Imagery of Oso Slide Area" layer to learn more about landslide susceptibility.

Analysis

1. What is the relationship between the dry Earth materials and slope stability?
2. What is the relationship between the moisture content of the Earth materials and slope stability?
3. Why do you think some areas around the United States are more prone to landslides than others? Use evidence from maps to support your response.
4. Are there areas around the United States that had a higher or lower susceptibility than you thought? _____ Why? Use evidence from maps to support your response.

Conclusion

Reflect on your hypothesis in the space below.

Applications

You are geologist assigned to map the landslide potential in a mountainous area with nearby population of approximately 20,000 people. Using what you learned in this lesson, from the "When Nature Strikes – Landslides" video to describe your research plan to map the landslide potential. Additionally, create a brochure or pamphlet for the people living in the area that describes what to do to prepare for a landslide.