



LEVEL
2

Cities at risk

from the Esri GeoInquiries™ collection for World Geography

Target audience – World geography learners

Time required – 15 minutes

Activity	Examine the proximity of major cities around the world to active volcanoes to identify cities at risk.
Social studies standards	C3:D2.Geo.1.6-8. Construct maps to represent and explain the spatial patterns of cultural and environmental characteristics. C3:D2.Geo.4.6-8. Explain how cultural patterns and economic decisions influence environments and the daily lives of people in both nearby and distant places.
Learning Outcomes	<ul style="list-style-type: none">Locate zones of risk to major cities from volcanic activity.Locate the cities with the highest population at risk from volcanic eruption.
Level 2 GeoInquiry Requirements	<ul style="list-style-type: none">A free school ArcGIS Online organization account. Instructors or students must be signed in to the account to complete this activity.Approximately 1.2 credits will be used per person in the completion of this activity as scripted.

Map URL: <http://esriurl.com/worldGeoInquiry3>

Ask

Where are global volcanoes and major cities located?

- Click the link above to launch the map.
- In the upper-right corner, click Sign In, and then use your ArcGIS Online organization account to sign in.
- With the Details button underlined, click the button, Show Contents.
- In the Contents pane, check the boxes to the left of the layer names Volcanoes - Active Only and Major Cities.
- Using the Zoom and Pan tools, explore the major cities and active volcanoes in the map.
- Which area on the map has the most major cities, closest to active volcanoes? *[It is difficult to tell just by visualization. Analysis tools will help.]*



Explore

What does a 20km buffer around active volcanoes look like?

- Turn off the two layers, Continents and Earthquakes Magnitude 5.7+.
- Turn on the layer, 20 Km Buffers - Active Volcanoes Only.
- Click Bookmarks and choose Africa Active Volcano Buffers. Zoom in two more times to see the buffered active volcanoes more closely.
- Turn off the Volcanoes Active layer and click one of the buffer circles.
- What field tells you how large the circles around the active volcanoes are? *[Buffer distance in km]*
- In the upper-left corner of the map, click the Default Extent (house) button.



Acquire

How can you use tools to help analyze a large amount of data?

- See the *Aggregate Points* ToolTip on the next page.
- Above the map, click Analysis, expand Summarize Data, and then click Aggregate Points.
- In the Summarize Data tool, set the following values in the corresponding numbered section:
 - Click the down arrow and choose Major Cities.
 - Set the layer to Polygon, and then from the drop-down list, choose 20 Km Buffers Volcanoes Active Only. Uncheck the Keep Areas With No Points box.
 - From the drop-down list, choose Population.
 - From the drop-down list, choose Sum.
- Leave the Use Current Map Extent box checked so that you will compute all active volcanoes on Earth. Always check Show Credits to ensure acceptable credit usage, and then click Run Analysis.

more ►



Analyze

Where are the cities closest to active volcanoes?

- Turn off the layers, Volcanoes, Earthquakes, and Imagery.
- Select the bookmark, Saudi Arabia. Click the new point created in Saudi Arabia.
- ? What is the volcano's name that is 20 km from a major city? What is the population of the city? [*East Medina volcano, 290,000*]
- Turn on the layer, Major Cities.
- Select the Peru bookmark.
- ? What is the name of the city and its population? [*Arequipa, 446,942*]



Act

Where would the most people be affected by the eruption of an active volcano?

- Open the table for the Aggregation of Major Cities layer that you created. Sort the Population field in descending order. (See the *View and Sort a Table* ToolTip below for details.)
- ? What are the volcano name and country and the name and population of the nearest city? [*Campi Flegrei and Vesuvio; Italy, Naples; 2,875,000*]
- ? What do you notice about this city as far as the nearest volcano? [*There are two volcanoes within 20 km of Naples.*]

VIEW AND SORT A TABLE

- Tables are only available for certain map layers.
- In the Contents pane, pause your pointer over a layer and click the Show Table button that appears under the layer name.
- Click the field name and choose Sort Ascending or Sort Descending.

AGGREGATE POINTS

- Provides a count of the points in a defined area.
- The result layer name must be unique, so consider adding three initials, school code, and a number after the layer name (example: FileName_REED_ABC1).

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...

- In this activity, a 20km buffer around volcanoes was created for you.
- Now create buffers around the Active Volcanoes within 30 km, 40 km, or 50 km.
- How does that change the number of cities within harm's way of an activity volcano?



TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these texts.

- World Cultures and Geography* by McDougal Littell
- My World Geography* by Pearson