

## Volcanoes



Figure 1: Mauna Loa – The largest volcano on the planet, located in Hawaii  
Source: [Huffington Post](http://huff.to/2acS61u) - <http://huff.to/2acS61u>

### Background Information

A volcano is an opening in the crust of the Earth through which magma and gases can escape to the surface, or a mountain that is formed from one or more volcanic eruptions.

Volcanoes act as an important force in shaping landscapes and creating new landforms. Their eruptions can be destructive but they can also help to cool the earth temporarily, as particles from a volcanic eruption are released into the atmosphere and shade incoming solar radiation. Through volcanic activity, mineral deposits and other natural features are discovered and used by people around the world.

From the following sources of information, students will learn about the importance of volcanoes, and the effects of volcanic and tectonic processes around the world. Students can use these sources of information to complete the **Volcanoes** assignment.

Review the following Web links for background information on volcanoes. All links were last accessed August 2, 2016.

- Volcanoes: <http://volcano.oregonstate.edu/volcanoes-0>
- Volcanoes 101 Video: <http://video.nationalgeographic.com/video/101-videos/volcanoes-101>
- Types of volcanoes: <http://pubs.usgs.gov/gip/volc/types.html>
- Earth The Power of the Planet video: <http://bit.ly/2atd1O3>
  - Iceland (14:21-18:19)
  - Surtsey (13:44-14:17)
- Plate tectonics: <http://www.geolsoc.org.uk/Plate-Tectonics/Chap2-What-is-a-Plate>
- Plate Margins/Boundaries: <http://www.geolsoc.org.uk/Plate-Tectonics/Chap3-Plate-Margins>
- Ring of Fire <http://nationalgeographic.org/encyclopedia/ring-fire/>
- The Mid-Atlantic Ridge: <http://bit.ly/2amgsUY>
- Mount St Helens: <http://pubs.usgs.gov/fs/2000/fs036-00/fs036-00.pdf>
- Mount Garibaldi: <http://volcano.si.edu/volcano.cfm?vn=320200>
- Iceland: <http://www.iceland.is/the-big-picture/nature-environment/volcanoes>
- Hawaii - Hot Spot: <http://www.marinebio.net/marinescience/02ocean/hwgeo.htm>
- Surtsey – An island formed from a volcano: <http://whc.unesco.org/en/list/1267>

- What are some good things that volcanoes do? <http://bit.ly/18yyrjf>
- Dangers and Benefits of Volcanoes video: <http://www.youtube.com/watch?v=rFWsF8ms6Pk>
- Top 5 Destinations for Volcano Enthusiasts: <http://bit.ly/2auRAAa>
- Volcanic Minerals: <http://volcano.oregonstate.edu/book/export/html/170>

## Lesson Contents

GIS lessons are assembled for teachers as a collection of resources that are needed to facilitate learning a specific topic or issue using mapping and spatial data. This lesson contains the following resources:

- **Lesson Overview (this document)**  
Contains the background information about the given topic, along with the **associated curriculum connections**, skills learned and materials required to complete the lesson.
- **Lesson Plan**  
Outlines the suggested workflow for using the contents of a lesson. This workflow is the same across all of Esri Canada Education's lessons. To download the lesson plan document, visit <http://esri.ca/en/content/lesson-plan>.
- **Presentation**  
A Story Map in ArcGIS Online for the teacher to introduce the GIS skills that will be studied. To view the Story Map, visit <http://arcg.is/2a2CfVt>.
- **Tutorial(s)**  
Hands-on documents referenced below including step-by-step instructions for learning GIS skills.
- **Assignment**  
A student activity intended to be the final part of a lesson. Students can complete the assignment by applying the GIS skills relevant to the lesson outcomes.
- **Data**  
The data required for this assignment can be found in ArcGIS Online. There are four datasets: "World Volcanoes" by EarthScienceAtlas, "Tectonic Plate Boundaries" by Esri\_TESS, "Volcanoes - Eruption Observed" by Esri Canada Education, and "Earth's Tectonic Plates" by EsriCanadaEd.

## Lesson Outcomes

By completing this lesson pack, students will gain the following curriculum-focused knowledge:

- **Identify major areas of tectonic activity in the world by plotting the location of active volcanoes on a map, and distinguish the areas by type of tectonic activity**  
(Alberta Grade 7 and 11 Science; British Columbia Grade 10 Science, Grade 12 Geography; Manitoba Grade 7 Science; New Brunswick Grade 7, 10 Science, Grade 10 Physical Geography; Northwest Territories Grade 7 and 11 Science; Ontario Grade 7 Geography, Grade 12 Science; Prince Edward Island Grade 7 Science; Quebec Secondary Cycle 1; Saskatchewan Grade 7 Science; Yukon Grade 12 Geography)
- **Describe natural phenomena that cause rapid and significant change to the physical environment**  
(Alberta Grade 7 Science; New Brunswick Grade 4, 10 Science; Newfoundland and Labrador Grade 4 Science, Grade 10 Geography; Northwest Territories Grade 7 Science; Nova Scotia Grade 4 Science, Grade 10 Geography; Ontario Grade 7 Geography; Prince Edward Island Grade 4 Science, Grade 11 Geography)

## Skills

Students will become comfortable with performing the following GIS skills in this lesson:

- Creating Features
- Adding Information to Features
- Using Tables and Filters

- Perform Analysis: Creating buffers
- Measuring Features.

## Topics and Themes

- Volcanism
- Plate tectonics
- Types of plate boundaries
  - Convergent, transform, subduction, divergent
- Oceanic and continental plates
- Mid-Atlantic Ridge
- Hot Spots
- Volcanic and Tectonic processes
- Ring of Fire
- Volcanic eruptions.

## Grade Range

- 4-12.

## Geographic Scope

- Global, National, Regional

## Time Required

The following time is required to complete this lesson:

- Presentation: [GIS Skills for ArcGIS Online](#): 10 -15 minutes
- Tutorials to be completed in class or for homework:
  - [Introduction to ArcGIS Online](#): 60-75 minutes
  - [Using Tables and Filters in ArcGIS Online](#): 10-15 minutes
  - [Perform Analysis: Create Buffers](#): 5 minutes
  - [Measure features in ArcGIS Online](#): 5 minutes
- Assignment to be completed in class or for homework: 75-90 minutes.

**Note:** For a complete learning experience, it is highly recommended that students complete the tutorials associated with this lesson. However, if the tutorials have already been taught, students can use them as a point of reference to complete the assignment.

## Materials Required

The following technology is required:

- ArcGIS Online (arcgis.com) subscription account
- Internet browser (e.g. Mozilla Firefox, Google Chrome, Apple Safari)
- Device (laptop, desktop, netbook).

## Production Date

The Education and Research Group at Esri Canada makes every effort to present accurate and reliable information. The Web sites and URLs used in this Lesson are from sources that were current at the time of production but are subject to change without notice to Esri Canada.

- Production Date: August 2016

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