

Lightning in the Peaks: Tutorial

⚠ This is a preview of the published version of the quiz

Started: May 18 at 4:31pm

Quiz Instructions

The study site for this lab located in Flagstaff, Arizona and the nearby San Francisco Peaks, consisting of a series of peaks and saddles that create a C-shaped ring of high points. This ring was created when a very large volcanic eruption blew the top off the composite volcano. The direction of the blast was to the east, and the decapitation of Mt. St. Helens in 1980 is thought to have been similar to what happened between 1 million and 400,000 years ago. All of the high points in the geovisualization are a result of volcanic processes discussed in this U.S. Geological Survey publication: <https://pubs.usgs.gov/fs/2001/fs017-01/> (<https://pubs.usgs.gov/fs/2001/fs017-01/>).

The San Francisco Peaks are visited by outdoor enthusiasts for skiing, mountain biking, and hiking. The mountains are also sacred to Native Americans living in the region including the Havasupai, Navajo, Hopi and Zuni. To Navajo, they are the sacred mountain of the west called Dook'oołíí. The Hopi villages on Black Mesa view the peaks as a ritually pure sacred space and the home of the kachina spirits, and alignment of sunset is used to calculate winter solstice.

The geovisualization allows you to fast-travel to the following locations seen below in a Google Earth screenshot [By the way, we can't use Google Earth, because there's no lightning data, no air temperature data, and no rainfall data].



You can also find background information on these locations to dive more into the history and context of these locations.

Fast Travel Spots	About the Fast Traveling Location
Flagstaff: 35.1983 N, 111.6513 W	Flagstaff was founded by Lumberjacks who celebrated the 100 th anniversary of the USA by nailing a U.S. flag to the top of a ponderosa pine. The early economy was based on the railroad, ranching and lumber. Currently, among other industries, it has a strong tourism sector.
Arizona Snowbowl N 35.33037 W 111.70459	Facing southwest, this ski resort was and is embroiled in controversy regarding using reclaimed water to make snow
Humphrey's Peak N 35.3464 W 111.6780	This is the highest point in Arizona at 12635'. Along with Agassiz, Fremont, Doyle and other peaks, it makes a rim of mountains that used to be a part of a much larger stratovolcano that was built up and blew apart in just the last million years.
Agassiz Peak N 35.32577 W 111.67756	Named for Louis Agassiz, the man who fought the 'Church' over the science of glaciation, it is the southernmost peak in the contiguous USA over 12,000 feet tall.
Fremont Peak N 35.32297 W 111.66074	There are many Fremont Peaks, honoring John C. Fremont who was an explorer, soldier, and the first candidate of the Republican Party for the office of President.
Inner Basin N 35.34324 W, 111.65019	After the top of the San Francisco Peaks was probably blown off and ejected to the east, the inner basin formed. Currently, the aquifer of the Inner Basin supplies the city of Flagstaff with much of its water.
Doyle Peak N 35.33011 W 111.64594	The name Doyle is present on U.S. Geological Survey topographic maps, but its original name was Shultz Peak.
Elden Mountain N 35.24099 W 111.59754	This is a volcanic (thick and pasty lava) dome, characterized by steep sides. Elden Mountain rests just above downtown Flagstaff.
Dry Lake Hills N 35.26132 W 111.63685	This location is a popular hiking and mountain biking area. Its volcanic, like most of the high points in Arizona.
Sunset Crater N 35.36371 W 111.50295	Sunset Crater is the most recent volcanic eruption in the San Francisco Peaks volcanic field, erupting about 1085. There's an associated basalt flow called Bonito.
O'Leary Peak N 35.40242 W 111.53262	O'Leary Peak is the highpoint in the area of Sunset Crater, named for a scout during the Indian campaigns of the late 19 th century. It is not a cinder cone, but a dome of thick viscous lava like Elden Mountain.
Doney Park: N 35.27300 W 111.50868	Doney Park is a residential area northeast of Flagstaff, a low spot named for a northern Arizona pioneer.
Fort Valley N 35.25795 W 111.73778	Fort Valley is an old settlement that has become a suburb of Flagstaff. It still holds small farms and ranches.
Schultz Pass N 35.2848 W 111.6336	Schultz Pass Road is considered by many to be one of the most scenic drives in the Flagstaff area. It is also the quickest route to get out of the city and go into the national forests. But you won't be alone. It's a busy area – and you can decide if the people who go there during the monsoon are making a good decision.
Lockett Meadow N 35.35880 W 111.61972	Lockett Meadow is where you would park if you tried to head out for a hike in the Inner Basin. It's a good gravel road, but I still would not recommend a passenger car.
Abineau Canyon Trailhead N 35.38356 W 111.67407	Abineau Trail is a steep hike! But it is worthwhile, no matter the season. You will make your own judgment if the Monsoon season (July, August, September) is a good idea!
Bear Jaw Flats N 35.39979 W 111.63595	This is a relatively flat area on the northern flank of the San Francisco Peaks. You can make a loop with the Abineau Canyon trail.

Lightning is one of those topics in physical geography that captures the imagination. Students have requested for labs about lightning, and until recently – it was not possible or safe). However, with the ability to map cloud-to-ground lightning strikes on a digital elevation model (DEM) enabled the development of a lab focused on students analyzing processes responsible for the distribution of lightning using video game technology. This lab's focus rests on you analyzing lightning strikes. However, there is more to this lab. Analyzing lightning strikes is part of the story. You get to analyze and study lightning in the context of the greater physical geography of the study area of the San Francisco Peaks in Northern Arizona.

The tutorial quiz starts out with a random selection of locations where you are asked to FAST TRAVEL to these spots, and then you are asked to read out different sorts of data you can see in the geovisualization (elevation from Space Shuttle radar, surface temperature obtained from Landsat data, dew points obtained from meteorological data and modeling, and a specially processed Landsat image designed to bring out characteristics of the surface rocks and vegetation).

Then, rest of the short tutorial quiz is designed to encourage you to explore the study area and introduce you to some of the physical geography of the region. We just want to make sure that you have an introduction to what you will be studying virtually.

Question 1

0.5 pts

QUESTION: In Fast Travel enter latitude 35.3444 and longitude -111.6661, and go to this location. Write down the surface temperature you see in degrees (°F). What is it?

You will be using "Fast Travel" a lot if you want to do the lab quickly.

- First - you open the menu using the arrow on the left side of the geoviz.
- Second - you click on Fast Travel
- Third - you enter the coordinates
- Fourth - click on the fast travel paper airplane icon and go

WARNING: There is a giant pool of questions and answers ... literally hundreds of questions in the pool. We are doing this giant pool in order to encourage students to actually go through this tutorial. In our experience, we know that students who skip the tutorial ... end up spending a lot more time being frustrated than those who go through all of these questions.

77.4

100.9

84.4

60.2

Question 2

0.5 pts

QUESTION: In Fast Travel enter latitude 35.4311 and longitude -111.6952, and go to this location. Write down the surface temperature you see in degrees F (°F). What is it?

You will be using "Fast Travel" a lot if you want to do the lab quickly.

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106.0

102.9

111.8

119.0

Question 3

0.5 pts

QUESTION: In Fast Travel enter latitude 35.3777 and longitude -111.6957, and go to this location. Write down the rainfall you see in mm. What is it?

You will be using "Fast Travel" a lot if you want to do the lab quickly.

- First - you open the menu using the arrow on the left side of the geoviz.
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206

88

167

183

Question 4

0.5 pts

QUESTION: In Fast Travel enter latitude 35.3595 and longitude -111.5879, and go to this location. Write down the color of the Landsat pixel that the avatar is standing on. What is it? [Select the closest answer, even if you think the color description is slightly off.]

You will be using "Fast Travel" a lot if you want to do the lab quickly.

- First - you open the menu using the arrow on the left side of the geoviz.
- Second - you click on Fast Travel
- Third - you enter the coordinates
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Light Green

Black

White

Dark Green

Question 5

0.5 pts

When the geovisualization starts up, the avatar lands at the top of Humphrey's Peak. Take a look at the information table provided about the different Fast Travel locations, and answer this question: What is the highest point in Arizona?

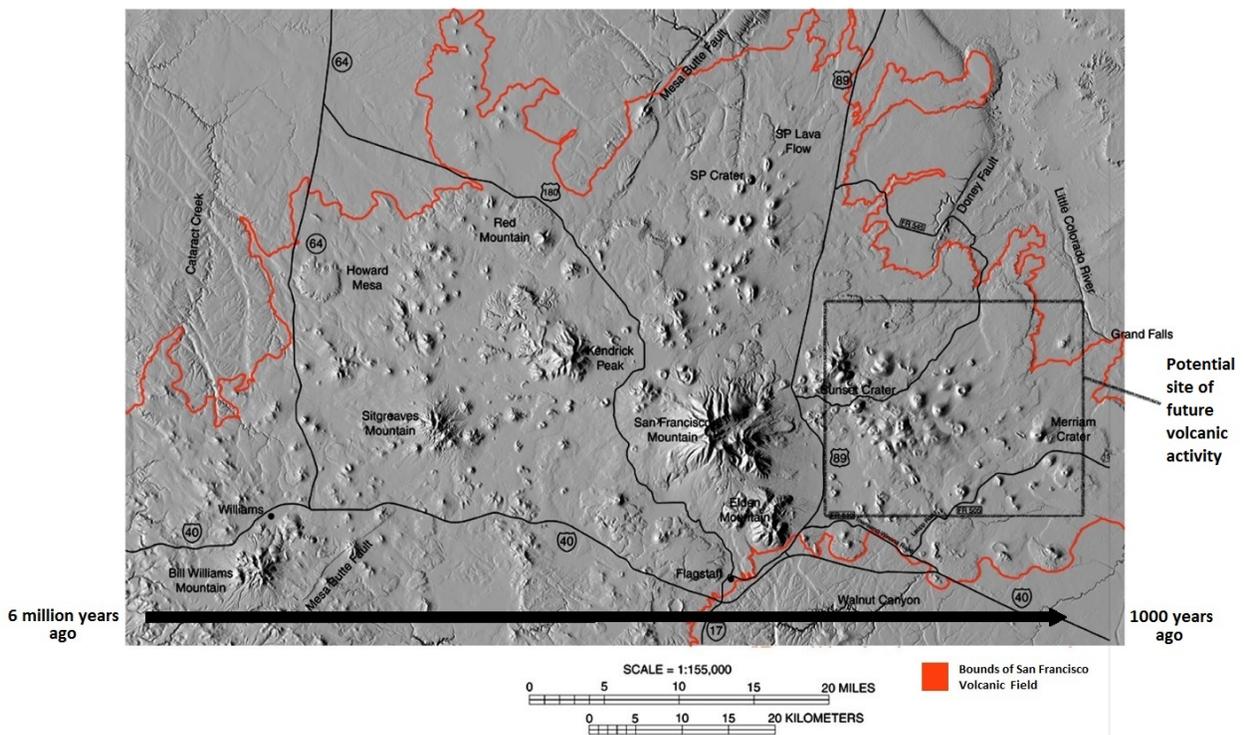
- Doyle Peak
- Elden Mountain
- Humphrey's Peak
- Agassiz Peak

Question 6

1 pts

"The Peaks" form a ring of peaks, a semi-circular form towering over the inner basin. As indicated in the overview, San Francisco Mountain (these peaks) is a composite volcano (like the Cascade volcanoes). It "blew its top" out to the east forming the inner basin within the last million years. San Francisco Mountain is part of a major volcanic field portrayed below by the U.S. Geological Survey. The very many "dots" are cinder cones, but there are also a few volcanic domes composed of very thick and pasty rhyolite/dacite lava.

San Francisco Volcanic Field Size: 5000 sq km; Vents: Domes, Cinder Cones (600)



One of these domes rests between Flagstaff and the composite volcano. Look at the graphic below. It is one of the Fast Travel spots in the geovisualization. **What is the name of this volcanic dome mountain?**

HINT: the answer is not only in the map above, but in the list of Fast Travel Spots in the instructions to this quiz.

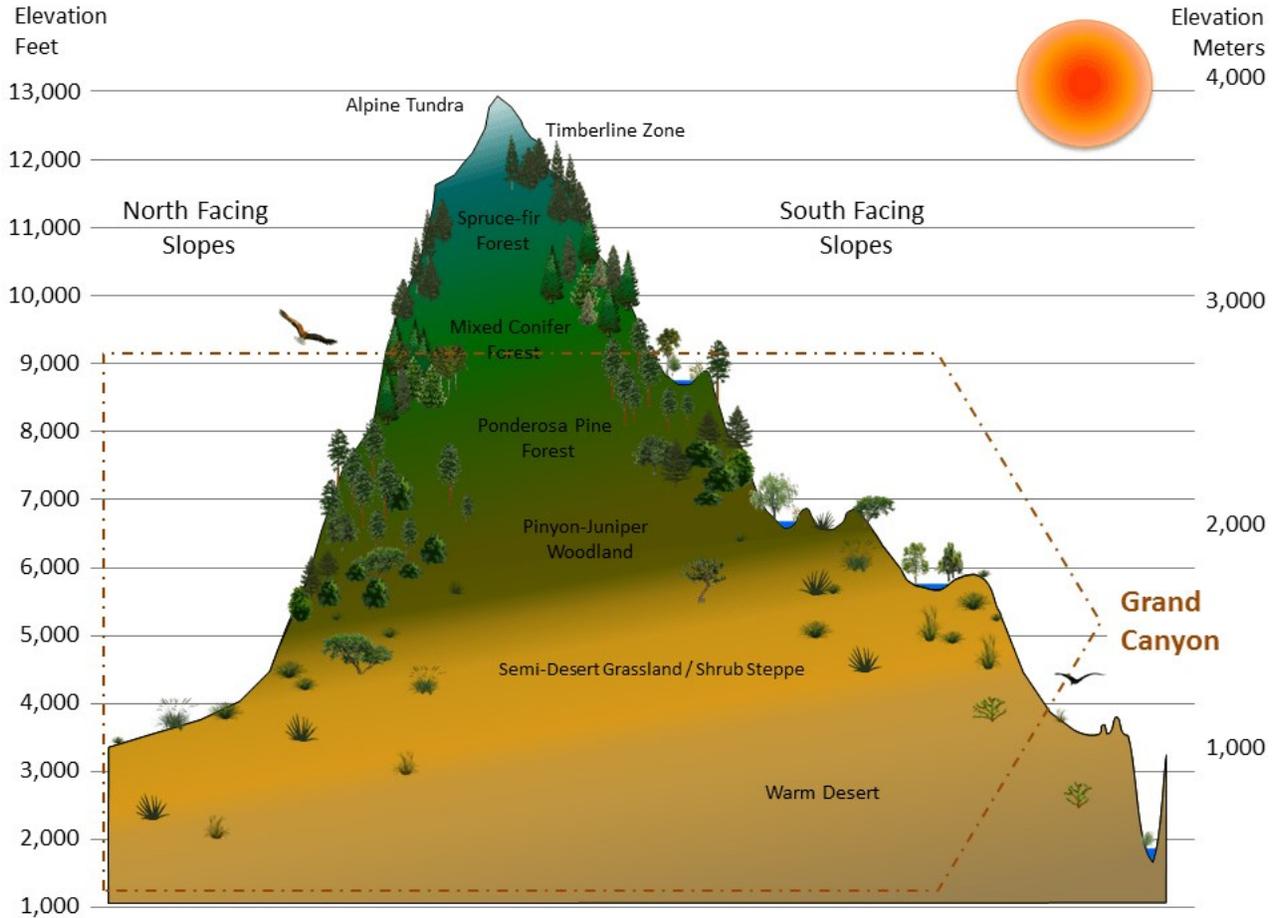
- Fremont Peak
- Elden Mountain

- Bear Jaw Flats
- Locket Meadow

Question 7

1 pts

The image below is made for the life zones Grand Canyon, but is generally applicable for the San Francisco Peaks and its surrounding topography.



You already know the elevation at the top of Humphrey's Peak. In the geovisualization, head towards the northern margin of the study area (Fast travel to 35.5753 , -111.7407) and look at the elevations you see. Now -- look at the graphic above. Based on the elevations that are in the study area of this geovisualization, what type of Arizona vegetation type would you expect to find?

- Warm desert in the lower elevation.
Ponderosa pine in the middle and higher elevation of the peaks.
- Mixed conifer forest in the lower elevation.
Ponderosa pine forest the middle and higher elevation of the peaks.
- Pinyon-juniper woodland/semi-desert grassland in the lower elevation.
Alpine tundra/spruce-fir forest on the middle and higher elevation of the peaks.

Ponderosa pine forest in the lower elevation.

Warm desert on the middle and higher elevation of the peaks.

Not saved

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