



Surface Process Hazards Unit 2: Landscape Feature Scavenger Hunt

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The following pages each have a series of questions about a different landscape. Refer to the provided maps and answer the questions.

Site 1: Northern Washington

Landscape Features:

Take a few moments to locate the following features on each map. You do not have to write or draw anything, just find them. If you have trouble, ask for help!

- A ridge
- A valley
- A river
- A lake/ocean
- A delta
- A manmade feature (town, road, etc.)

Eastern Morphology:

1. In a few words, describe the morphology of the eastern portion of the map area.
2. Is this a low- or high-relief area? How do you know?
3. A few remnants of glaciers remain in the high peaks of the eastern portion of the map area, however these were once much larger and filled the wide valleys, trending roughly east–west across the northeastern map area. Sketch a profile view across one of these wide valleys. Does the profile of the valley look more U-shaped or V-shaped?

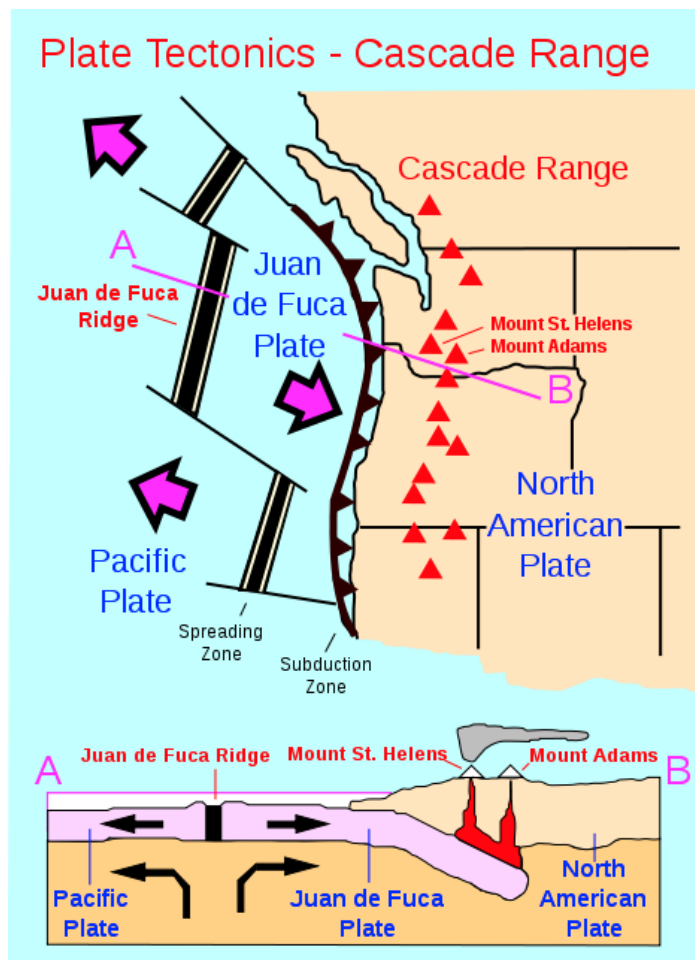
Western Morphology:

4. In a few words, describe the morphology of the western portion of the map area.
5. Is this a low- or high-relief area? How do you know?
6. What do you think has caused the roughly north–south trending smooth streamlined features especially visible in the southwestern corner of the map?
7. Describe the shape of the rivers in the western portion of the state. What kind of rivers would you characterize them as (bedrock, braided, meandering)?
8. How do the rivers and river valleys in the west compare to the rivers in the east?

Landscape feature: Faults!

Westernmost Washington resides on the upper plate of a subduction zone with the Juan de Fuca Plate subducting below the North American Plate (see figure below). That means this region is prone to earthquake and is dissected by many faults related to this plate boundary. The recently mapped “Seattle Fault” was in the news lately!

9. Besides the north–south trending streamlined features, the edge of the mountain range, and the wide roughly east–west trending glacially carved valleys mentioned above, can you find some other linear features in the landscape? The major faults of the region run roughly WNW–ESE. One passes right below the city of Seattle!



“Cascade Range related plate tectonics” by Surachit—Own work. SVG based on the public domain USGS image here: [1]. Image renamed from File: Cascade Range-related plate tectonics.svg. Licensed under CC BY-SA 3.0 via Commons - https://commons.wikimedia.org/wiki/File:Cascade_Range_related_plate_tectonics-en.svg#/media/File:Cascade_Range_related_plate_tectonics-en.svg

Site 2: Southern Washington

Landscape feature #1: drainage patterns

As a fluvial system (river/stream) flows over the Earth's surface, it sculpts the Earth's surface through erosion and deposition and creates what's referred to as a **drainage**. There are several different types of drainage patterns that you should be looking for as you complete the landscape-feature scavenger hunt.

One drainage has been identified for you on the map of Southern Washington. Look carefully at the rest of the hillshade and see if you can identify some other drainages. In particular, take a look around Mount St. Helens.

1. Make a map-view (overhead view) sketch showing the pattern that the drainages form surrounding Mount St. Helens. In your sketch, label the locations of the drainages and the location of Mount St. Helens and indicate with arrows the direction of water flow through the drainage.
2. How would you describe the appearance of this drainage pattern?

Find the river that passes through the town of Longview.

3. How does this drainage pattern look compared to the drainage pattern surrounding Mount St. Helens? Sketch, in map view, the drainage pattern that this river forms. In your sketch, label the location of the drainage, the town of Mount St. Helens, and indicate with arrows the direction of water flow.
4. Refer back to the hillshade and your sketch. Does this river seem to be confined to one channel, or are there multiple channels?
5. Approximately how wide is the floodplain for this channel?

Landscape feature #2: stratovolcano

Mount St. Helens, one of the Cascades, is an active stratovolcano that last experienced a major eruption on May 18, 1980. It has been identified for you on the map of Southern Washington.

6. Make a map-view sketch of the topographic pattern formed by Mount St. Helens. Then, refer back to the hillshade and your sketch.
7. A central crater (depression) is located near the top of Mount St. Helens. You should be able to identify the location of the crater on the hillshade by looking for a steep **scarp**. Does the scarp form a complete ring? If not, on which side (N/S/W/E) of the volcano is the scarp absent?

Site 3: Upstate New YorkLandscape Features:

Take a few moments to locate the following features on each map. You do not have to write or draw anything, just find them. If you have trouble, ask for help!

- A ridge
- A valley
- A river
- A lake/ocean
- Evidence of agriculture

Glacial Morphology:

Glaciers have been expanding and retreating over North America since ~3 Ma. The last time glaciers retreated was about 16,000 years ago, just after the Last Glacial Maximum (LGM). At that time, ice-sheets extended well into upstate New York! When the glaciers retreated, rivers resumed the job of carving up the landscape. See the map of the ice edge at ~20ka to the right.

We can see clear evidence of this glaciation in the landscape of upstate New York. Note the two very distinctive morphologies visible in the map area.

1. Use a few words to describe the landscape in the northwestern portion of this map.
2. What produced the north–south trending, streamlined features especially prevalent in the northwestern corner of this map area? Do they trend in the same or different orientation to some of the wide valleys currently occupied by lakes?
3. The large lakes in this region are called “The Finger Lakes.” The town of Ithaca is located at the south end of longest lake, Cayuga Lake. Cayuga is 42 miles long and more than 400' deep! Do you think the valley walls on either side of the lake are steep (U-shaped profile) or more gently sloping (V-shaped profile?) What erosive agent do you think is responsible for carving these wide and deep valleys?
4. Describe the morphology and drainage pattern of the southeastern portion of the map—do you think the valleys are U-shaped or V-shaped?
5. Can you imagine a line dividing the portion of this map reflecting a *glacial morphology* and the portion of this map reflecting a more *fluvial morphology*?

While ice and water have carved out the valleys, valley locations are greatly influenced by the regional fracture patterns. This region of upstate New York is not currently tectonically active but retains scars of past activity in the form of fractures or planes of weakness in the bedrock.

6. Can you see about 3 different valley orientations that may reflect the underlying bedrock fracture pattern. List their approximate azimuthal directions here.

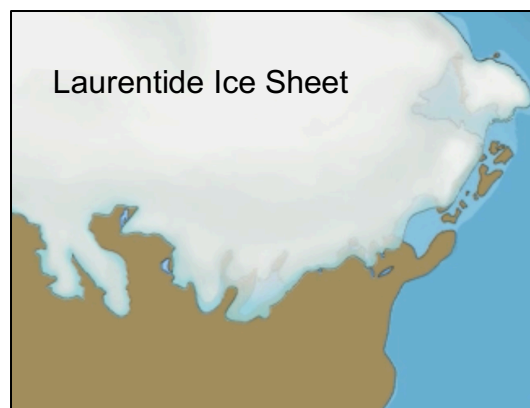
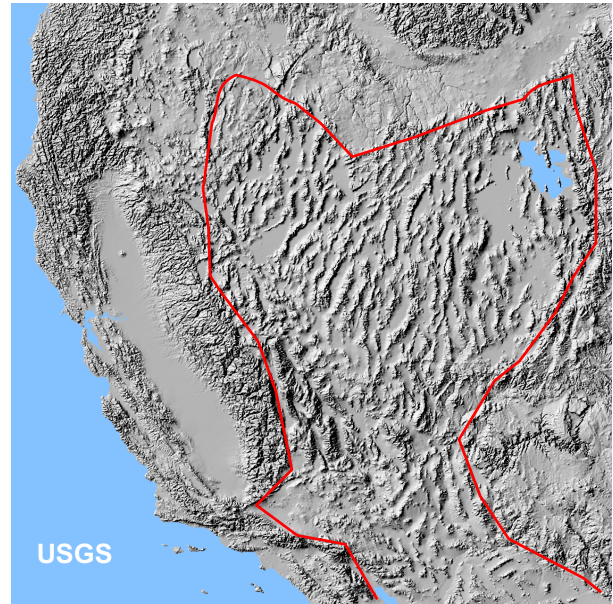


Image from http://emvc.geol.ucsb.edu/1_DownloadPage/Download_Page.html; released for educational use.

Site 4: Northern UtahLandscape Features:

Take a few moments to locate the following features on each map. You do not have to write or draw anything, just find them. If you have trouble, ask for help!

- A ridge
- A valley
- A river
- A lake/ocean
- A manmade feature (town, road, etc.)
- A linear north-south trending mountain front
- Snowy mountain peaks
- Evidence of agriculture

Basin and Range Province:

This region in Utah is the easternmost extent of the Basin and Range Province. In the small map above, notice the “wormy” appearance of Ridges and Valleys, all trending more or less north–south. This same terrain extends westward all the way to the Sierra Nevada Mountains of California and extends north to central Oregon/Idaho and south to Mexico. See the region outlined in red in the small map to the right (https://nationalmap.gov/small_scale/mld/srgrayi.html).

Area in red shows the greater “Basin and Range” region. The maps you will exam for this exercise are from the far northeastern part, just to the east of the Great Salt Lake (shown in blue).

1. Describe the different morphologies of the eastern and western portions of this map area.
 - a. Generally, on which portion of the map area (east or west) do we find large basins, some of which are filled by lakes?
 - b. In which portion of the map area do we find rivers incising into a mountain range? Do you think the rivers carving U-shaped or V-shaped valleys?
 - c. Look at the lakes on the eastern side of the map area; do you think they are naturally occurring or man-made? Why do you think so? Lakes are in river valleys (can see by shape of lake).
2. Describe the locations and trend of any linear landscape features in this area.
 - a. In particular, in what general direction do linear landscape features trend near to the locations of the major cities: Salt Lake City, Provo, Sandy?
 - b. What is the major linear feature bounding the western side of the mountains? Why?

3. Look at the area around Magna.
 - a. Just south of Magna, you can see an alluvial fan (in the hillshade) emanating from this range. Can you find another example of an alluvial fan on the hillshade? Describe its location.
 - b. Just north of Magna there is a strange polygon-shaped flat area. Any guesses for what this is?

Site 5: Prince William Sound, Alaska**Landscape Features:**

Take a few moments to locate the following features on each map. You do not have to write or draw anything, just find them. If you have trouble, ask for help!

- A ridge
- A valley
- A river
- A lake/ocean
- A glacier
- A vegetated area

Glacial landscape features:

Glaciers still dominate the landscape here in Alaska! *Alpine* or *mountain* glaciers are confined and carve deep U-shaped valleys and jagged peaks as they move over the Earth's surface. In the aerial imagery, you should be able to see narrow high peaks in between the heads (origin points) of various glaciers.

1. Look closely at several of the glaciers on the aerial imagery and notice that some parts of the glacier are white and other parts look brown, blue, and gray. Propose a hypothesis about which types of Earth materials you think compose these two different regions of the glaciers.
2. Measure the approximate width, in miles, of the glacial valleys. Since all of the glacial valleys are not the same width, you may report your answer as a range of widths.
3. Which cardinal directions (estimated) do the glaciers flow? (For example: east–west)
4. Find the main drainage divide on the map. Which direction does it trend?

Landscape feature #2: tectonic landscape features:

Alaska is tectonically active with large earthquakes of various focal depths occurring quite regularly! The convergent plate boundary between the Pacific and North American plates lies along the coast of western North America and creates an active subduction zone. Further to the south of our study area, the principal tectonic motion is strike-slip. Movement between the Pacific and North American plates creates a variety of landscape features, including active faults. Study the imagery and look for evidence of faults.

5. Do you see any linear features in the map area? If so, which way do these linear features generally trend?
6. One characteristic of tectonically active landscapes is the presence of ridges that end abruptly or have crests that are offset and/or take sudden turns. Locate one or two offset ridges and give their approximate location using latitude/longitude and or the scale bar. What is causing the offset along the ridges?

7. On March 27, 1964, at 5:36pm, a 9.2-magnitude earthquake occurred at an epicenter about 85km (50 miles) west of Port Valdez. What are some other hazards (in addition to ground shaking) that might result from an earthquake in this location?

8. While the fault along which this earthquake occurred may not be visible in this map area, many faults are visible in the landscape here. It is not clear whether these faults are currently active, but they still are a strong presence in the landscape. List a few landscape features that help you determine the rough location of some of the major roughly east–west oriented faults in this area.