

Formation of Deserts & Other Climate Topics

**Directions:**

- Write your name, today's date, and the class period on the upper right corner of a piece of loose-leaf paper.
- Write the heading "*Formation of Deserts & Other Climate Topics*" on the top left corner.
- Read all the of the background information.
- Answer all of the following questions on loose-leaf paper.
- You do not need to write the question. However, be sure to number each answer clearly.
- You will need your textbook.

**Purpose**

- Explain factors in the existence and location of Earth's deserts
- Analyze atmospheric, geographic, and oceanographic data in relation to desert formation

**Background**

Why are there deserts and why do they exist where they do? Deserts are geographic places that receive less than 25 cm, or 10 in., of rain each year. They are usually found in areas where moisture-laden air fails to come in contact with the land. Many deserts are hot in the daytime and cold at night. It is not uncommon for their temperature to change as much as 50 °F from day to night. This is primarily because of their low humidity, between 10-20%. By contrast, deciduous forests in the eastern United States, with about 80% humidity during the day, absorb heat and hold much of it during the night. Their average temperature change in the summer is only about 20 °F from day to night. Water has high **heat capacity** and must lose a lot of energy for a small temperature change, whereas soils can change temperature quickly.

While deserts cover 20% of the Earth's surface they are not randomly distributed. And not all deserts are hot. They can exist in cold regions as well, *provided they lack precipitation*. Below are examples of how this phenomenon explains the existence of most of the world's deserts, which exist generally in four types of regions.

**I. High Pressure Areas**

Many people who watch TV weather reports know that low pressure generally means rainy, damp conditions while high pressure brings dry, clear weather. The same rules apply to geographic regions. Belts of high pressure around Earth, near latitudes of 30°N and 30°S, seem to correspond to many of the world's hot deserts. High-pressure zones also occur at the poles, which are cold deserts.

**II. Mountain Areas**

Mountain ranges tend to remove water from the atmosphere as air masses rise to move across the range, from windward to leeward, leaving much drier air to descend on the other side of the mountain range. These are sometimes called rainshadows deserts (*Figure 7-6 on page 152*).

**III. Coastal Areas**

Some deserts are coastal, a fact that might seem to contradict the lack of moisture rule for deserts. Atmospheric moisture comes from the sea—remember the hydrologic cycle. The air over the ocean may be nearly saturated with water, but the total amount of water depends on the water temperature. Cold coastal water does not evaporate easily and can even remove atmospheric moisture. Cold air holds less moisture. When this cold, low humidity air moves onto land that is warmer than the ocean, the air warms (warm air holds more moisture than cold air) and absorbs moisture from the land, making it drier than it would normally be. Combinations of ocean currents create large ocean surface circulation called gyres. In the northern hemisphere the gyres move clockwise and in the southern oceans counterclockwise. Some currents such as the Peru Current, move from the poles to the equator, bringing cold water along the coast. Others, like the Gulf Stream on the east coast of the United States, bring warm water from the tropics. (*Active Figure 7-2 on page 149*)

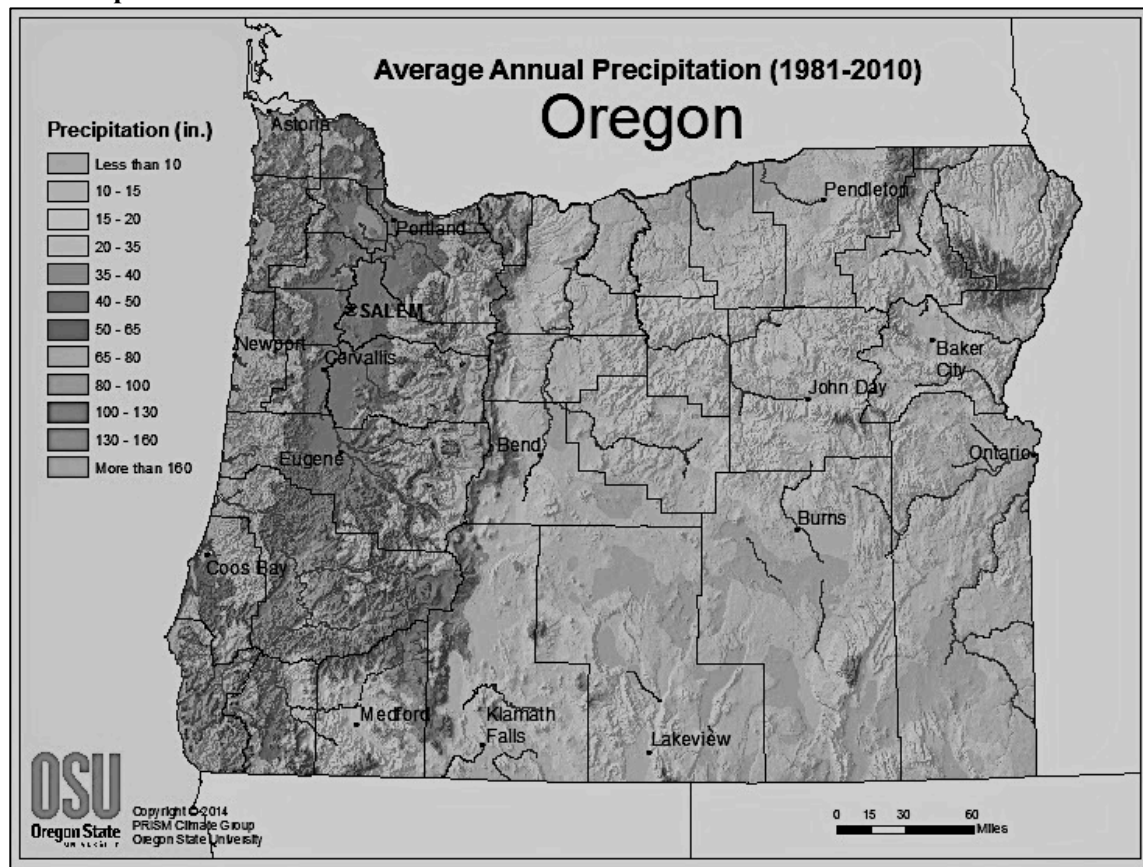
**IV. Inland Areas**

The interiors of large continental landmasses are usually much drier than the coasts. Moist air from offshore usually loses much of its water by the time it reaches the interior.

Refer to your notes, *Figure 7-3* on page 149 of your textbook (Plus, Supplement 7 on page S26-S29), and other sources as needed to answer the following question.

- 1) At what latitude on the diagram of the Earth, would you expect to find a low-pressure area? Describe the process by which low pressure develops and the type of weather is associated with it? Be specific. What type of climate zone and ecosystems are found at this latitude (As shown on *Active Figure 7-2*)?
- 2) At what latitude on the diagram of the Earth, would you expect to find a high-pressure area? Describe the process by which high-pressure develops and the type of weather is associated with it? Be specific. What type of climate zone and ecosystems are found at this latitude (As shown on *Active Figure 7-2*)?
- 3) Between what two latitudes are the prevailing winds known as the Westerlies found? Identify two ecosystems found within this area.
- 4) Between what latitudes do the Northeast and Southeast Tradewinds blow?

Analyze the map and data shown below.

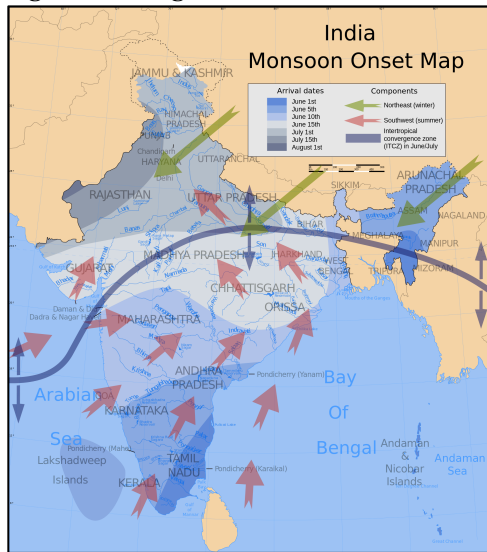


- 5) What differences do you observe, with regard to precipitation, between Western and Eastern Oregon?
- 6) The Cascade Mountain Range separates Eastern and Western Oregon. Based off of what you have learned what is a likely explanation for the disparity in precipitation between Eastern and Western Oregon?

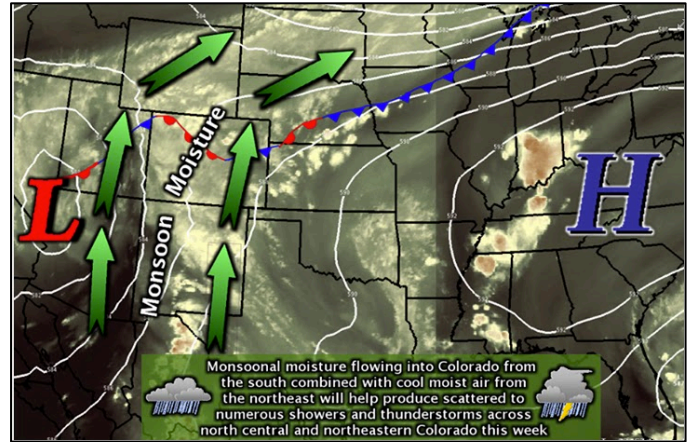
Refer to *Figure 7-3* & *Active Figure 7-2* on page 149 of your textbook to answer the following questions.

- 7) The Atacama Desert of Chile is on Pacific Coast of South America and on the western side of the Andes Mountains. The prevailing winds at this latitude are the Southeast Tradewinds that blow from east to west. Identify and explain **two** likely causes of the Atacama Desert.
- 8) A dry arid type of grassland called chaparral, which is prone to frequent wildfires, characterizes the southern coast of California. This region is west of the Sierra Nevada Mountain Range, which the Westerlies blow across from west to east. Is Southern California's chaparral the product of the rainshadow effect? Explain.
- 9) What is a likely explanation for Southern California's chaparral if it is not due to the rainshadow effect? Explain.

Refer to *Figure 1* & *Figure 2* below to answer the following questions.



**Figure 1**



**Figure 2**

- 10) Figures 1 shows monsoonal flow in India, which is bordered on the north by the Himalaya Mountain Range. Figure 2 shows the North American monsoonal flow, which is bordered on the west by the Rocky Mountains. Explain how monsoonal flow develops.
- 11) Explain why there is a large desert in central Asia (north of the Himalaya), yet there is no desert in the central plains of the United States, instead there is a temperate grassland ecosystem (moderate moisture).

Refer to your notes, the textbook (Supplement 7 page S26-S29), and other sources as needed to answer the following question.

- 12) With respect to El Niño explain normal conditions and then explain El Niño conditions. Explain how the weather phenomenon known as El Niño can transform an arid coastal desert into an area of torrential downpours resulting in catastrophic floods and mudslides. Also, explain how El Niño conditions can devastate Peru and Ecuador's highly productive coastal marine ecosystems.