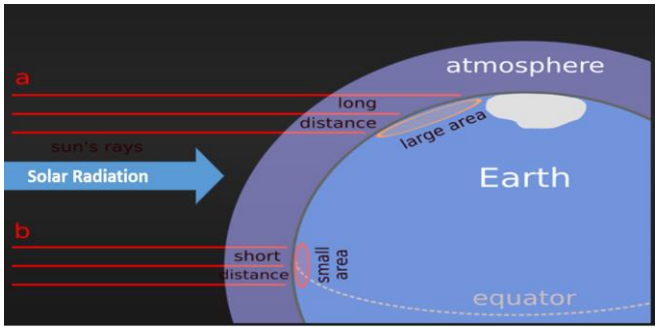
Climate From West to East in Oregon

Why is Oregon's weather the way it is? Why is one place so much different than the other? And like its western sibling states, California and Washington, there are more differences in climate as you move about the state, than you would experience with most of the states in the country. *Let's take a look at the different climatic elements that give us all those differences in more detail:*

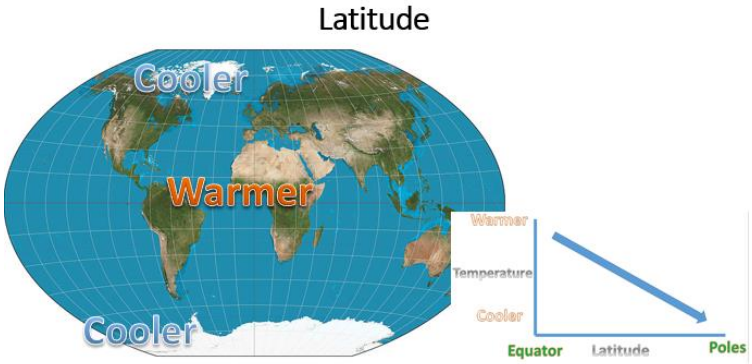
- Latitude
- Wind and ocean patterns
- Nearness to the oceans
- Elevation
- Topography

Latitude

One of the greatest determinates of climate the world over is latitude. Generally speaking, temperatures decrease as you move from the equator to the poles. This is simply a matter of physics. The sun strikes the equator at the highest angle. As you progress towards the poles the angle decreases, and the same amount of solar radiation (insolation) is distributed over a greater area. The diagram below illustrates this concept.



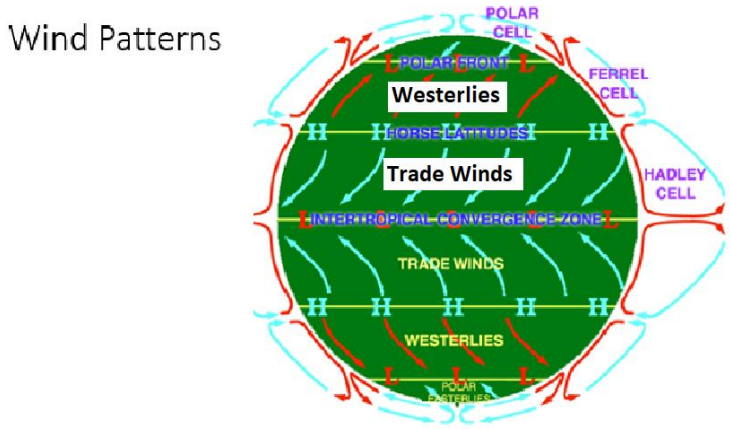
Much of Oregon is about 45 degrees north latitude. That means that the angle of the sun's rays will average about 45 degrees off the horizon (in the middle of the day) over the year. That compares with areas near the equator where the sun will be directly overhead. Using that logic, you could assume that places north of Oregon, would generally be cooler, and areas to the south warmer, on average. But latitude, although an important factor in weather controls, is not the only one.

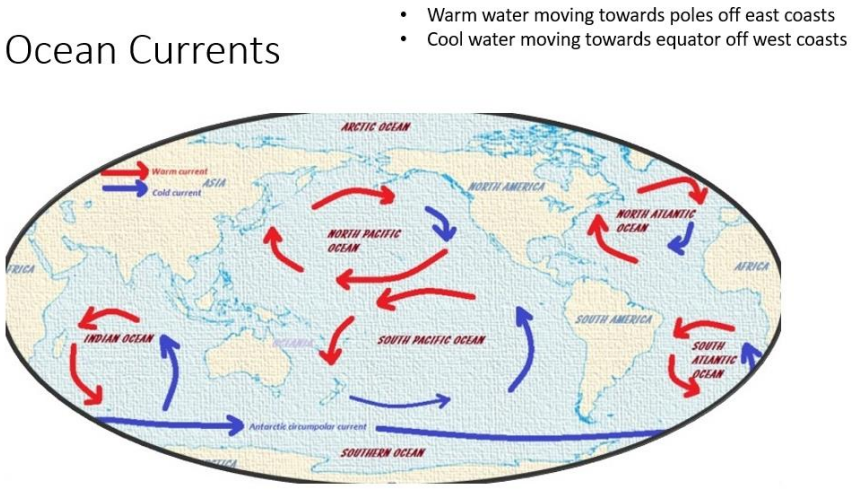


Wind and ocean patterns

Because of the difference of temperatures between the equator and poles, there is a tendency for the warm air masses to equalize and move towards the cooler areas. And because of the spin of the earth these air masses don't move in a straight line, but generally flow from west to east (known as the westerlies) in our neck of the woods, and west to east in the lower latitudes (the trade winds). Ocean currents to a large degree follow these same movements. In a nutshell, what that means is that cooler ocean currents and storms come from the west. However there are seasonal differences in these patterns. In the winter, the storm track flows directly into the Pacific Northwest, with some exceptions during some years. (More about that in the climate change section.) During the summer this storm track moves north giving areas like Washington more summer rain than say, California. Oregon may get some of this summer rain. And, of course, every year is a little different.

As you move further inland another factor comes into play. Eastern Oregon, as well as much of the Rocky Mountains, is subject to moisture that advances up from the southeast. When the ground warms up in the summer, this moist air rises and condenses, producing many summer thunderstorms. So areas in this part of the state will have wetter summers than areas closer to the ocean.





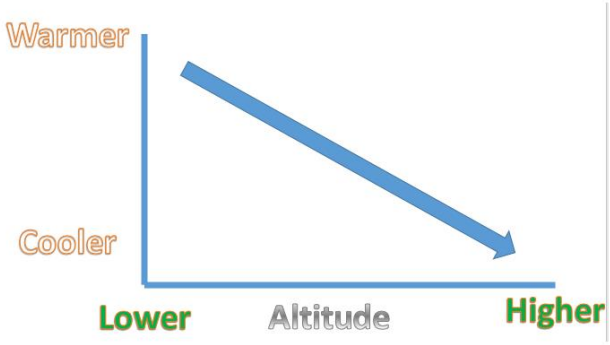
Nearness to the oceans

Another basic fact of physics is that the ocean holds heat longer than land. The thin surface of a land mass will heat up faster, and cool down faster. What this means is that areas near the ocean will be more moderate in temperature than further inland. You will see that in the precipitation chart later in this article. Towns near the coast will be cooler generally in the summer, yet warmer in the winter. That effect will also be seen in the day and night distinction. Areas near the coast tend to have a warmer night than areas inland, as well as cooler days. This will be somewhat mitigated by a cooler ocean current offshore.

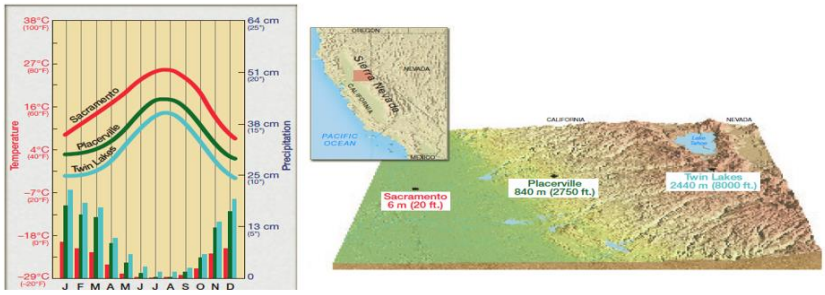
Elevation

As you might expect, the higher you go up a mountain, the colder it gets. This happens because as altitude increases, air becomes thinner and is less able to absorb and retain heat.

As the lower image depicts, temperature has a nice correlation with elevation as you progress east from Sacramento, through Placerville and Twin Lakes. You will also notice that precipitation will increase as you progress up a mountain. That is another law in physics – the cooler the air, its ability to hold water as a gas decreases, and it condenses into a liquid, also known as rain or snow.



Altitude Effects on Local Climate



Physical Geography: A Landscape Appreciation, McKnight / Hess

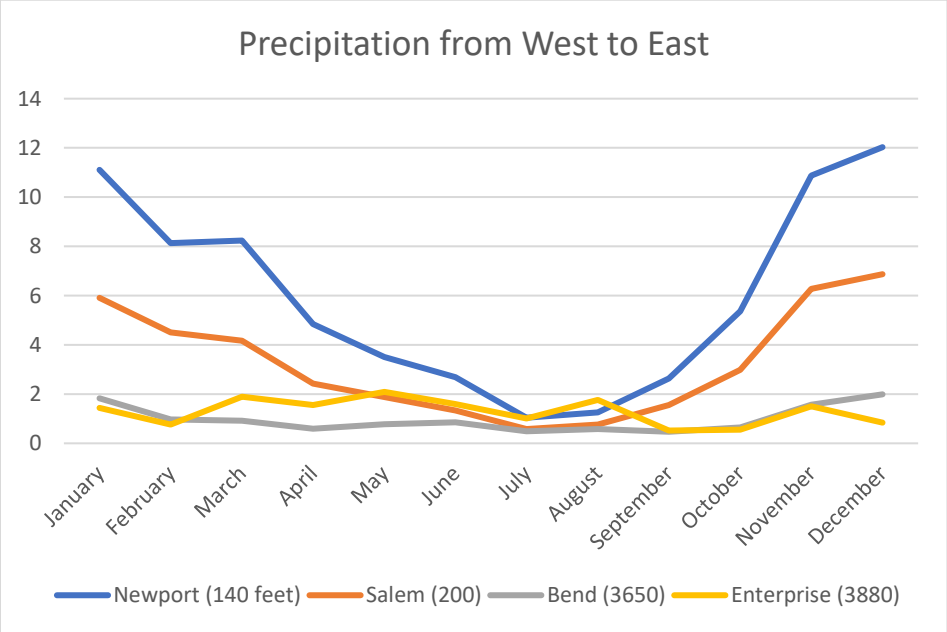
Topography

Elevated areas, besides having a direct impact on temperature and precipitation as you ascend, also have an impact on the leeward side of the area. Once you go over a mountain the air will descend, and as the temperature increases, its ability to hold water as a gas – increases – therefore you have less rain. So areas on the east side (leeward) of our mountains will get less rain than those on the windward side. Areas on the east side of the Cascades, even at the same elevation will get a lot less rain that those on the west side.

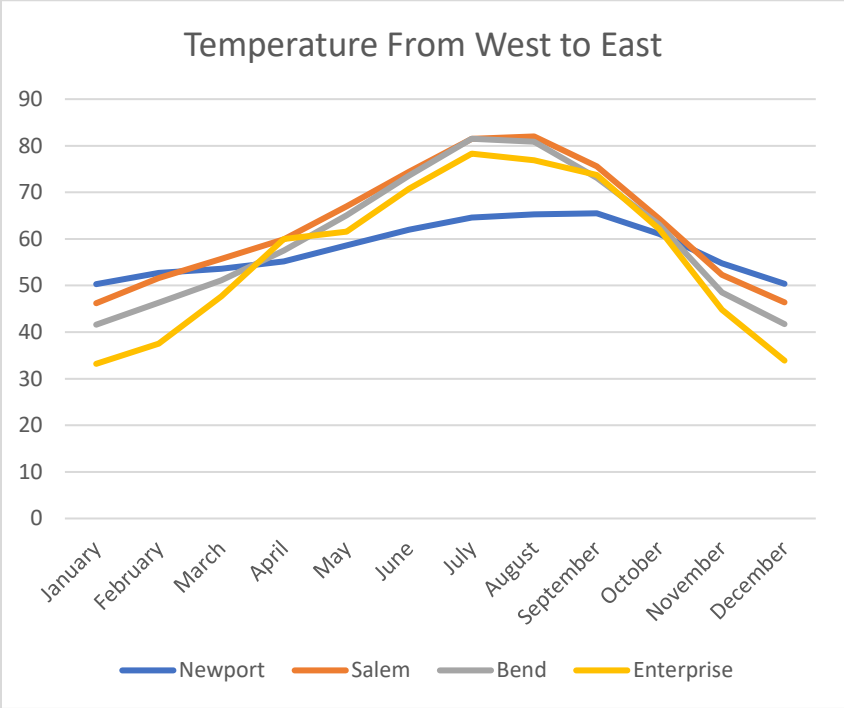
How these climate controls affect the Oregon climate.

Put all these elements together and it results in a mélange of climates. Cities that are not far from each other can exhibit very different climates. For instance a city on the east side of a mountain can have substantially less rain than a city just a few miles away on the west side. Or an inland town can be 20 degrees warmer than a town just 20 miles away on the ocean.

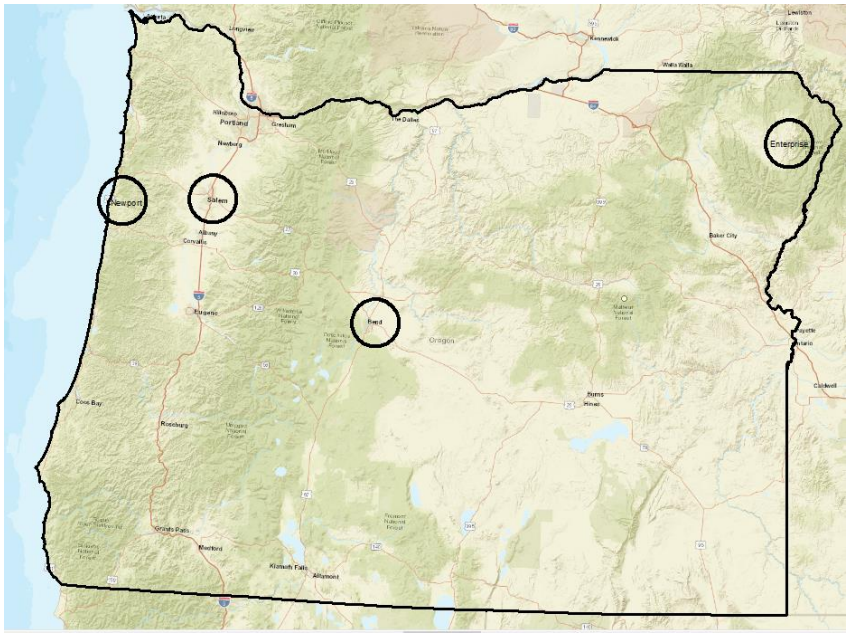
Look at the precipitation pattern of Newport on the coast and how its maximum is in the winter months. Contrast that with how Enterprise's precipitation is fairly constant from month to month. Salem has a pattern somewhat the same as Newport, but is a little less extreme. And Bend is similar to Enterprise, although Enterprise seems to have a slight spring/summer maximum. You will also notice that Bend receives the least of all the stations because of its "leeward" location – the Cascades wring out most of the moisture from the storms that typically come in from the west. Enterprise gets more precipitation than Bend (particularly in the spring and summer) because of thunderstorms.



Temperature also exhibits a coast to inland (west to east) difference, where Newport, being closest to the moderating influence of the ocean, doesn't change nearly as much as the inland stations. Enterprise, being the most inland location has a greater change from winter to summer.

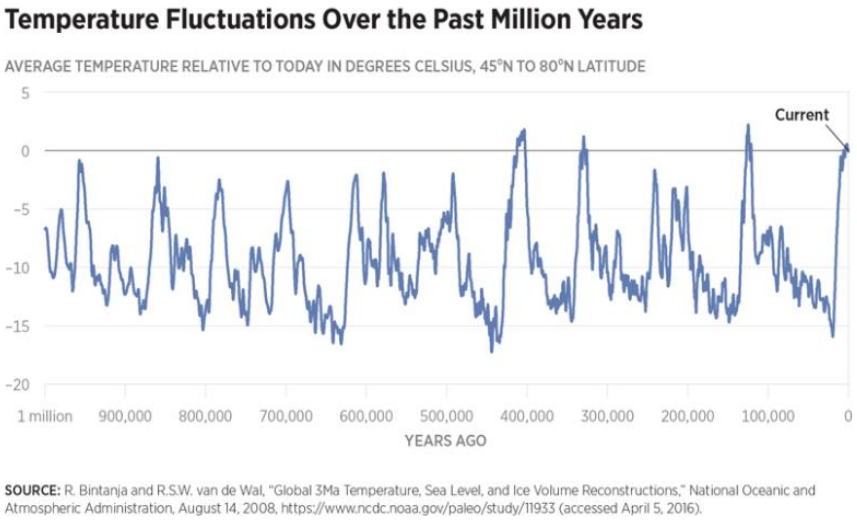


Location of Four Cities (From west to east, Newport, Salem, Bend, Enterprise):



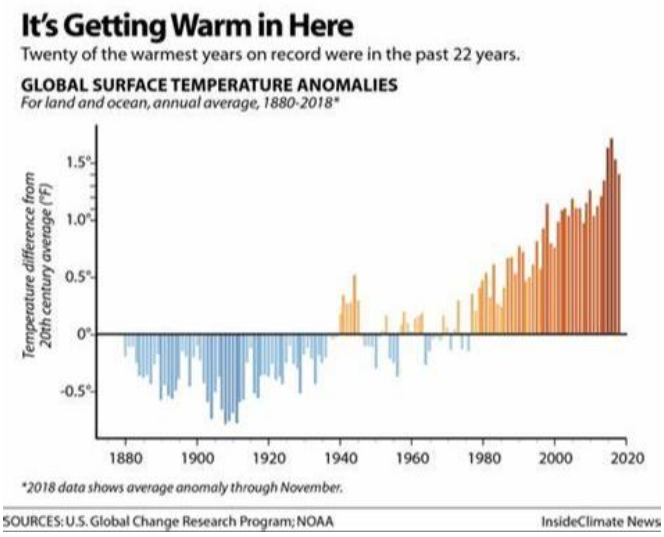
Past Climate and Climate Change

It's obvious to most of us that weather can change dramatically from day to day. Well, the long-term patterns, the climate, can also change greatly over time. This chart below shows how the climate has changed over the last million years. The changes were because of a complex set of natural influences, obviously not man-made. The bottom line is that climate change has occurred throughout earth's history.

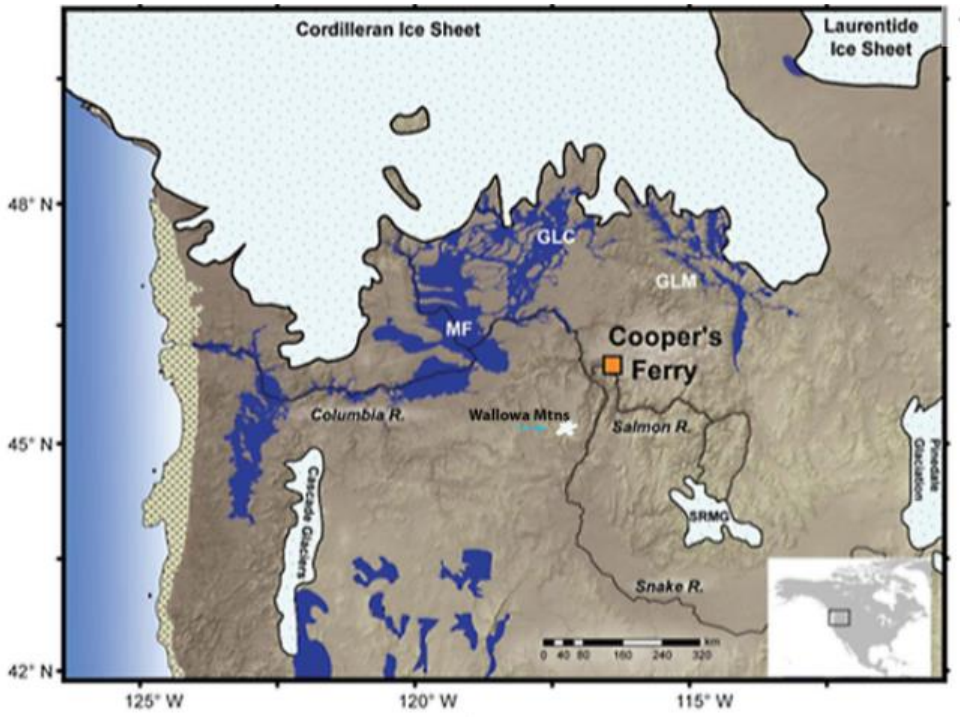


SOURCE: R. Bintanja and R.S.W. van de Wal, "Global 3Ma Temperature, Sea Level, and Ice Volume Reconstructions," National Oceanic and Atmospheric Administration, August 14, 2008, https://www.ncdc.noaa.gov/paleo/study/11933 (accessed April 5, 2016).

But it is also obvious to us earth scientists, that things are changing more quickly since the last half of the last century. This next chart below shows how the temperatures have increased dramatically in the last 140 years. Nearly all scientists say this is because of human influence, which they attribute mostly to greenhouse gases. Studies have shown that this impact has affected the High Desert as well.



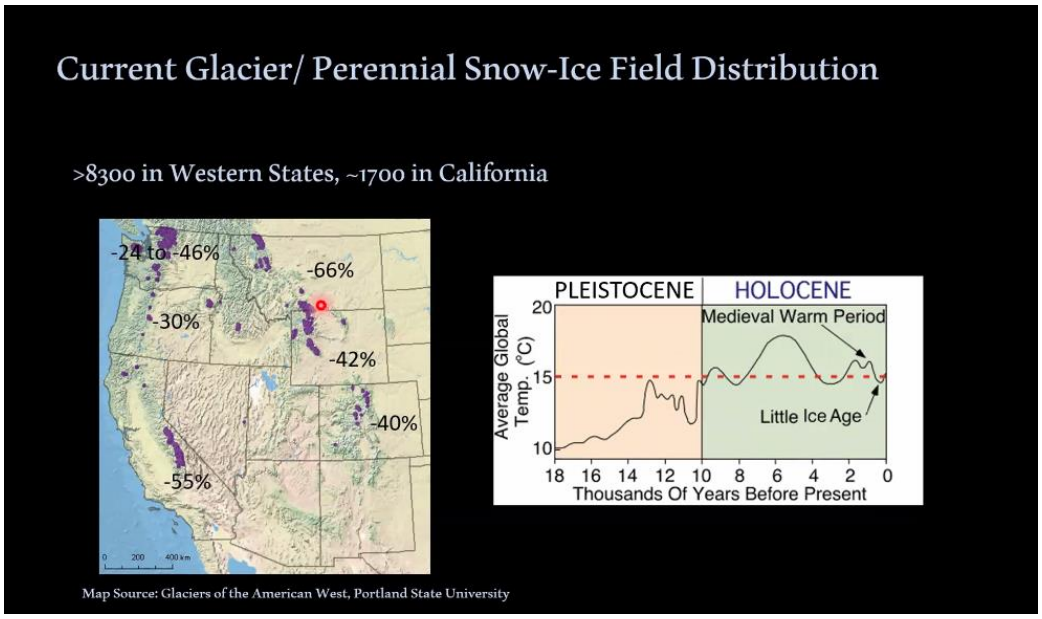
Here are a few maps showing how this has affected our western landscape over the last twenty thousand years. Glaciers were very much evident in the northwest. They carved out large areas of the state of Washington, as well as nearly all of the Cascades. During the maximum extent of these glaciers, where temperatures were cooler, and precipitation greater, many lakes also formed.



TheNorthwest 16,000 years ago and location map for the Cooper's Ferry site. At 16,000 years ago, glaciers occupied most of Canada, the largest Missoula floods and the Bonneville flood through Hells Canyon had not yet happened, and the Wallowas still wore their ice cap. Projected regional environmental aspects at −16,000 cal yr B.P. are based on probable extents of Cordilleran and Laurentide glacial ice at 16,000 years ago, Cascade and Salmon River mountain glaciers (SRMG), Pinedale glaciation extents, positions of Glacial Lake Missoula (GLM) and Glacial Lake Columbia (GLC), the modeled path of the Missoula Flood (MF) and its impoundment pool, smaller northern Great Basin pluvial lakes, and shoreline extents along the Pacific outer continental shelf (shown as a tan dotted area at left).

Modified from Loren Davis/Oregon State University

In more recent times this has had an impact on the glaciers that exist in the west. All of them have decreased in size as the map below shows. In fact several have completely disappeared.



Charts and Maps where source is not indicated were prepared by Bob Earle