GEOG 313 Are Summers in Western Oregon Getting Hotter and Drier?

Background

In this project we will explore both questions in the title, using temperature and rainfall together, and then also looking at a measure of drought known as the Palmer Drought Severity Index that incorporates both. But why not just use precipitation data to assess drought? That’s a good question, and in most environments, [precipitation deficits are the most important driver of drought](https://www.ncdc.noaa.gov/cag/national/time-series) – particularly during the cooler months when there is very little evaporation. But in the warmer months, evaporation and evapotranspiration are also major factors in determining availability of moisture for plants.

Question: Imagine two summers (June, July, August) that each received a total of 3 inches of rainfall, considered average for a particular region. One summer was cooler than average, the other was warmer than average. Everything else being equal, which one would be more likely to stress out plants that are not drought adapted? Explain why:

With that in mind, what happened Labor Day evening in 2020 in Oregon that made international news? We had a dramatic increase in forest fire activity, made much worse by very strong, dry, and hot winds from the continent, the worst possible combination. The hot, dry, strong winds spread the existing fires rapidly, and spread others that may have been started by humans – the latter a topic still under investigation as I write this.

Hotter and drier makes it easier for wildfires to get started, and for existing ones to spread rapidly. Our summers in Western Oregon (defined roughly here as including the Cascades and all the way to the Coast) are reliably drier than our winters, so dry summers are nothing new and are in fact the norm. But being hotter than average, and having less rainfall than average, makes the risk of wildfires worse. Of course, changes in the availability of surface vegetation as fuel is also a risk factor, and in some areas this has been greater risk factor in recent decades than it was before fire suppression became the norm, mostly since the late 1800s. But in recent decades the overall amount of fuel near or at ground level has not changed that much from year to year in most places, yet the area burned has grown tremendously, and most of the worst fires have happened during hotter, drier summers.

Accordingly, our task is to investigate long term changes in summer temperatures, rainfall, and their product, drought. And since one topic that affected almost all of us in early September of 2020 was forest fires, I hope you all will find this exercise interesting or at least significant.

Research questions, looking at recent decades in Western Oregon:

1. Are summers warmer on average than they were in previous decades?
2. Are summers experiencing less precipitation on average than they were in previous decades?
3. Are droughts more likely than they were in previous decades?

Time Series Data are from the [National Oceanic and Atmospheric Administration](https://www.ncdc.noaa.gov/cag/national/time-series). They include monthly precipitation, average temperature, and the calculated Palmer Drought Severity Index (PDSI). The [PDSI](https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi#:~:text=The%20Palmer%20Drought%20Severity%20Index,more%20extreme%20values%20are%20possible.) uses temperature and precipitation data to estimate relative dryness, and its data output include negative (dry) values up to 4 and rarely as high as 10 and positive values of the same magnitude indicating relative wetness. PDSI accounts for residual moisture for the period leading up to the month of record in the user inquiry. We will work with data from the State of Oregon as a whole to first get a big picture, and then zoom into to each region of Western Oregon for a closer look. The Western Oregon climate regions following the NOAA classification are the Coastal Area, Willamette Valley, Southwest Valleys, and Northern Cascades.

You will need to fill out the Excel Data Sheet that I have designed for this project. It is posted in Moodle near where you found these instructions that you are now reading.

Source data website: <https://www.ncdc.noaa.gov/cag/national/time-series> Make sure in the above data set that you choose the Climate at a Glance option in the blue panel on the left.

Here is video to walk you through the data acquisition process, remembering to choose the Climate at a Glance option in the blue panel on the left. (yes, I just repeated myself)

<https://www.youtube.com/watch?v=gAylpk-nnFc&t=348s>

<https://www.youtube.com/watch?v=gAylpk-nnF>

After you have entered data in all 20 cells, have a look at patterns and at whatever else seems interesting, and then answer the following questions.

1. How much different are the 60 year temperature trends comparing the four subregions? Which one shows the strongest decadal (10 years at a time) trend?

2. For the four sub regions, 2000 to 2020, where are the two strongest temperature trends? How does these compare with the 1960-2020 decadal trends?

3. For rainfall 1960-2020, what is the trend for Oregon as a whole, per decade, on average?

4. For rainfall 1960-2020, Western Oregon subregions, do any of them not show a negative trend?

5. For rainfall 2000-2020, Western Oregon subregions, how many of them show a positive (wetter) trend? For that one or those – go back and produce the graph of it/them. And look at the overall pattern since 1895: Would it be intellectually honest to tell someone that this/these region(s) are getting wetter in the era of climate change? Discuss.\*

6. From the Palmer Drought Severity Index data, what is the Oregon per decade rate of change from 1960-2020, when compared with the 1895 to 2020 average (wetter or drier)?

7. How about the PDSI for the 2000 to 2020 period? And how many data points over that 20 year period were drier than the long term average of 1895 to 20000 for Oregon as a whole? Would it be intellectually honest to tell someone that Oregon is getting wetter in the era of climate change? Discuss.\*

8. For the Western Oregon subregions, what is the pattern of PDSI over time? Again, note any exceptions, and interpret.

9. From a technical viewpoint, discuss the utility of looking at 60 year trends (expressed as a number per decade like we have seen) versus looking at 20 year trends . Pretend that you are responding to a man you heard on talk radio claiming that Oregon summers are getting wetter.

10. In two or three concise sentences, summarize what was found in the data in such a way that it could be quoted in an interview with the press – where the interviewer asks: ***Are summers in Western Oregon getting hotter and drier?***

\*(one thing you might do in such cases is look at the number of years out of 20 that were actually above the 1895 to 2020 average.)