Are Summers & Early Fall in Oregon Getting Hotter and Drier?

***Due date in Canvas***

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 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.

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 Oregon (you won’t answer these yet):

1. Are summers/early falls getting warmer on average than they were in previous decades?
2. Are summers/early falls 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. 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, compared with normal for the region in question. 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, and also the High Plateau (including Bend). 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 Canvas 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.

**There is video to walk you through the data acquisition process that is posted in Canvas.**

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

1. How much different are the 43 year temperature trends comparing the subregions? Which one shows the strongest decadal trend?

2. Compare the decadal temperature trend for the State of Oregon for July – October (1980-2022), with that of July – September (1980-2022). Which one shows larger change?

3. For each of July, August, September and October, look at temperature trends for 1980 – 2022. Summarize.

4. For precipitation 1980-2022, what is the trend for Oregon as a whole, per decade, on average?

5. For precipitation 1980-2022, of the subregions, do any of them not show a negative trend? Discuss.

6. For precipitation 1980-2022, 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 1900: Would it be accurate to tell someone that this/these region(s) are having wetter summers/early falls in the era of climate change? Discuss.\*

7. From the Palmer Drought Severity Index data, what is the Oregon per decade rate of change from 1980-2022, when compared with the 1900 to 2000 average (wetter or drier)?

8. Describe the trend of the PDSI for the 1980 to 2022 period for the State of Oregon. And how many data points over that 43 year period were drier than the long term average of 1900 to 2000 for Oregon as a whole? Would it be accurate to tell someone that Oregon is more drought prone in the era of climate change? Discuss.\*

9. For each of the Western Oregon and High Plateau regions, what is the trend, if any, of PDSI over time? (1980 – 2022) Again, note any exceptions, and interpret in a sentence or two.

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 Oregon getting hotter and drier? (note that we could have looked at all the subregions but to minimize work we did not)***

What to turn in (no electronic submissions)

Go back and make a graph of July through October Temperatures 1900 – 2022, including the trendline for 1980-2022. Make the graph, as per video instructions, and then print it, or if it does not print well, first save as a PDF and then print it. Be sure to turn this in with your spreadsheet and your answers to the questions above. You should print out the four pages of instructions because there is also an early question on page 1 that you should answer. And finally, print out the spreadsheet with the data you have entered.