Abstract

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Estimated Main Sources of Water for the Sandy River Watershed

The Pacific Northwest is famous for its wet climate from the Cascades. This weather is responsible for many rivers, one of these rivers being the Sandy River. However, the amount of precipitation may vary by elevation. The reason for this study was to discover the main sources of water for the Sandy River Watershed and the correlation to elevation. To first discover the extent of the Sand River Watershed, a DEM data set was used to calculate the water delineation. The DEM data set used a resolution of 10m, so it had a much higher average of accuracy in large scale. Once the watershed and streams were calculated, a feature was added to visualize and count the number of potential streams. Which added up to 1,137 potential water sources that flow into the Sandy River. To discover the main sources out of the total, a precipitation raster data map of Oregon was added. The data had measured the amount of precipitation in 800m resolution over the last 30 years. By overlaying the two sets of data the, it revealed where the most amount of precipitation was located in the watershed. The expected results were that the highest elevation would output the most amount of precipitation. However, from the study I found that the actual highest contributor to the Sandy River Watershed was Palmer Peak and the area surrounding it. Mt. Hood did also come as a main source of water, but lower in amount than Palmer Peak, there by disproving that elevation is the sole factor in precipitation amount for the Sandy River Watershed.

Key Terms: DEM, Digital Elevation Model, Watershed, GIS, Water Delineation

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Estimated Main Sources of Water for the Sandy River Watershed

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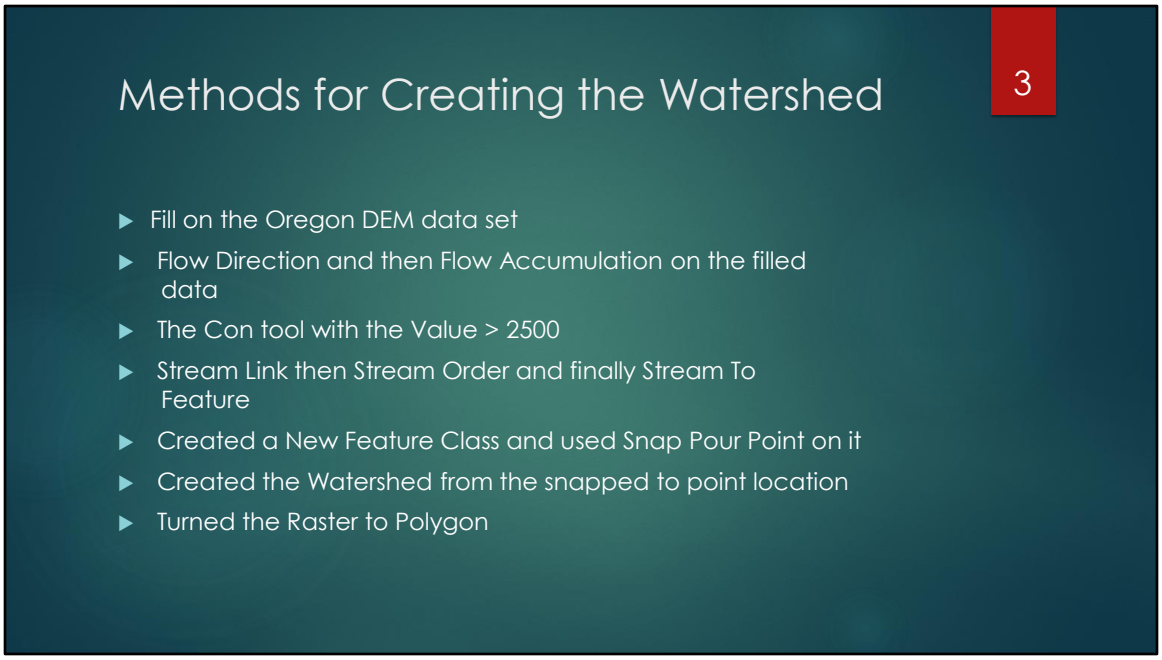


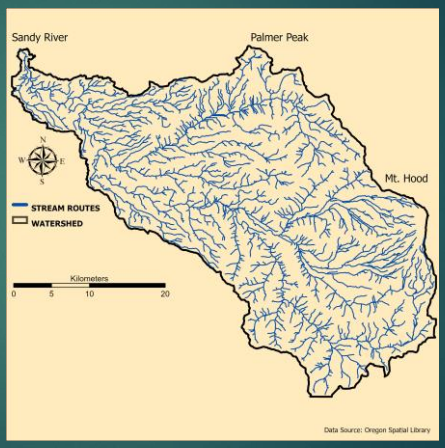
Methods

In creating the watershed, first a DEM file was needed. I found a high resolution one on the Oregon Spatial Library at 10m resolution. Once I found this, I plugged into ArcGIS Pro and section off an area of what I was reasonably sure was the boundaries of the Sand River Watershed. I used Fill on the DEM in case of any holes in the data, then I calculated the Flow Direction and Flow Accumulation of it. I then Configured it to the Value is greater than 2,500. After that I used Stream Link and then Stream Order and finally Stream to Feature to create the streams. I created a Snap Pour Point and placed it at the end of the Sandy River before it flows into the Columbia. After that I ran Watershed to created the boundary of the Sandy River Watershed, and finally turned that boundary from a Raster to Polygon.

The Sandy River Watershed

The watershed was calculated using a Oregon 10m DEM data set.

It was all processed through ArcGIS Pro.



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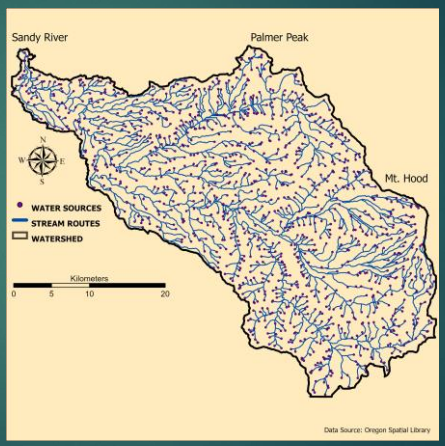
The Number of Potential Water Sources

The purple points represent the number of potential water sources.

In the end it add up to be 1,137 water sources, that flow into the Sandy River.



I created a feature to visualize and count the number of potential water sources for the Sandy River. After all the points were placed, the number tallied up to over 1,137 possible water sources in the Sandy River Watershed.

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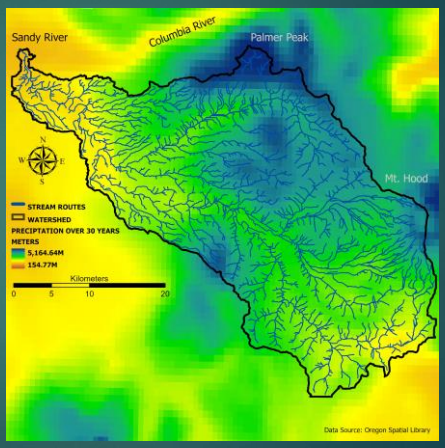
The Precipitation Amount

This data set was measured at 800m resolution, and totaled up from the last 30 years worth of precipitation.

The two main areas of precipitation are firstly Palmer Peak and the surrounding area, and secondly Mt. Hood.

This data set was heavily peer reviewed.



To be able to estimate the main sources of water to the Sandy River Watershed, I had to find a precipitation data map. I found one that was measured at the resolution of 800m and spanned from 1981-2010 in measuring precipitation in meters. At first glance 5,000 meters of water seemed to much, however if you think about how large the are each pixel represents it makes sense. Also, according to the data source, the map was heavily peer reviewed before publishing.
As can be seen in the map, the major spot of precipitation are Palmer Peak and the area around it, and to no surprise Mt. Hood.

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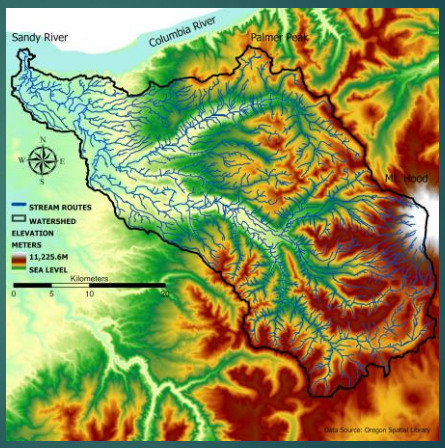
The Elevation of the Watershed

The most noticeable high elevation feature of the Sandy River Watershed is Mt. Hood.

While Palmer Peak is much higher than sea level, it seems to be less than half the elevation of Mt. Hood



For the elevation map, I just used the DEM data set again and changed the symbology to be more visually pleasing. As can be seen, Mt. Hood stand out amongst everything as the highest elevation in this map and in the state of Oregon as well. Therefore, the highest measurement of the elevation is depicted by Mt. Hood while sea level is depicted by the Columbia River, giving a complete range of elevation in the map. Palmer Peak is noticeably much lower in the elevation than Mt. Hood and surround peaks, yet stand right between the Columbia River and Mt. Hood.

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The Precipitation of Mt. Hood

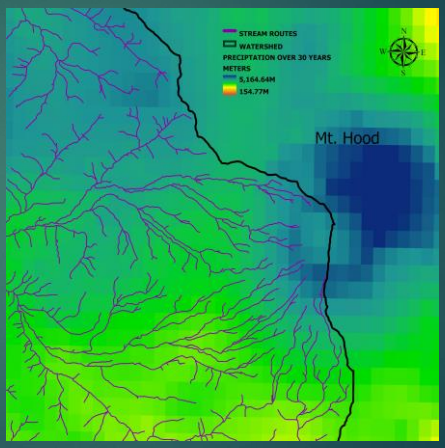
The precipitation at Mt. Hood seems to vary, but most of it seems to be located on the eastern side of the mountain.

On the west side, it still receives a large amount but not as much the eastern one.

The estimated amount seems to be over 4,000 meters of water measured in the last 30 years total.

Mt. Hood is the second main source of water for the Sandy River Watershed, however only around 32 potential sources are located there.

This a little less than 3% of all the sources.



Mt. Hood's precipitation is more prominent on the East side of the mountain peak. Where as the West side still has a decent amount, but not as much as the other side. By viewing the precipitation map, the estimated amount of water on Mt. Hood for the Sandy River Watershed is around 4,000m. There are around 32 possible sources of water on Mt. Hood, which makes less than 3% of the whole watershed in quantity, but quite likely takes up a much higher percentage in water flow.

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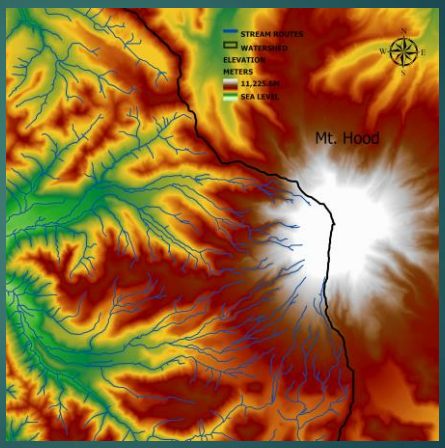
The Elevation of Mt. Hood

As the highest peak in Oregon, Mt Hood stand at around 11,225 meters above sea level.

This elevation is great for capturing ocean weather traveling East.



Mt. Hood's elevation at 11,225 meters makes it perfect for capturing weather heavy with precipitation from the Pacific Ocean as it travels East.

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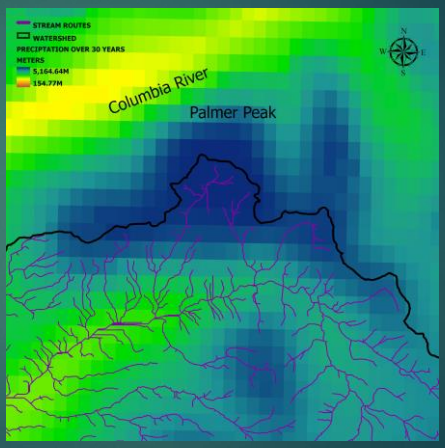
The Precipitation of Palmer Peak

The precipitation around Palmer Peak seems to be some of the most concentrated in the state.

The estimated amount seems to be over 5,000 meters of water measured in the last 30 years total.

Palmer Peak is the main source of water for the Sandy River Watershed, however only around 50 potential sources are located there.

This a little over 4% of all the sources.



Palmer Peak's precipitation as well as it's surrounding areas seem to have some of the most concentrated in the state. Based on the precipitation map, the amount of water coming from precipitation is over 5,000m. Palmer Peak and the surrounding areas of concentrated precipitation make up around 50 of the potential water sources in the watershed, making up a little over 4% of the entire Sandy River Watershed.

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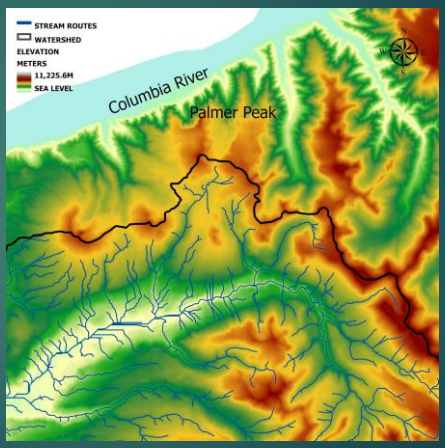
The Elevation of Palmer Peak

Palmer Peak while much lower than Mt. Hood, still stands at a fairly high elevation of around 4,000 meters.

It is ideally located at the beginning of the Columbia River Gorge on one side and Mt. Hood on the other to funnel precipitation in its area.



Palmer Peak's elevation seems to not be as much of a factor in its precipitation as Mt. Hood and more its location. Palmer Peak at it's highest is only around 4,000 meters almost a third of Mt. Hood. So, being between the Columbia River and Mt. Hood, and being the start of the Columbia River Gorge, Palmer Peak seems to funnel large amounts of precipitation as it travels eastward through it.

Conclusion

Overall, my expected results were partially correct in that Mt. Hood being a main source. However, I overestimated elevation being a factor and underestimated location. This is clearly shown with Palmer Peak overall receiving more precipitation than Mt. Hood, and therefore being a bigger potential source of water to the Sandy River Watershed.

Data Used:

- Oregon 10m Digital Elevation Model (DEM)
- Oregon Average Annual Precipitation, 1981-2010 (30 arc-second)