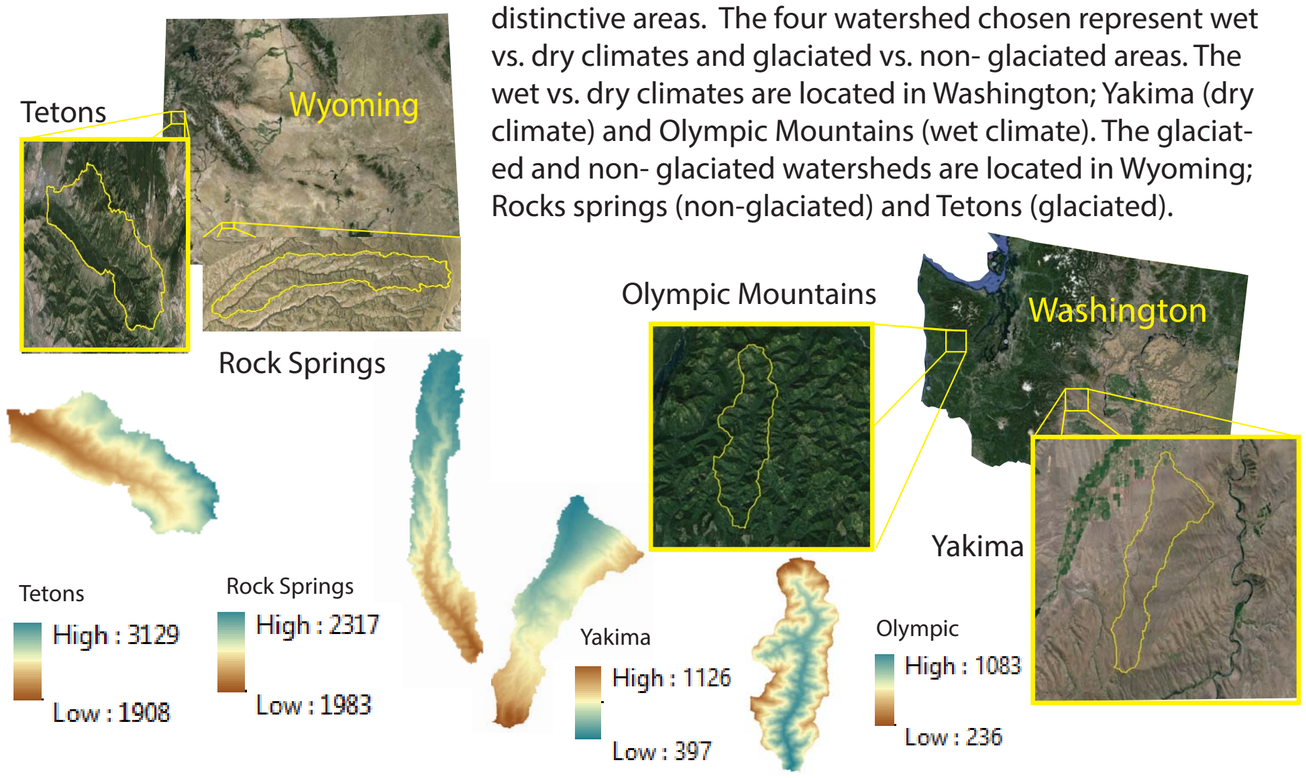
Watershed Characteristics

Samantha Vega and Jeremy Lange April 2015

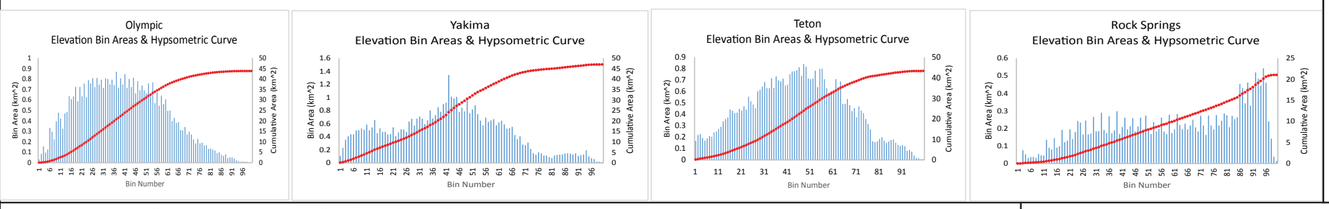
Watershed Metrics

The goal of this project was to choose four watersheds from distinctive areas. The four watershed chosen represent wet vs. dry climates and glaciated vs. non- glaciated areas. The wet vs. dry climates are located in Washington; Yakima (dry climate) and Olympic Mountains (wet climate). The glaciated and non- glaciated watersheds are located in Wyoming; Rocks springs (non-glaciated) and Tetons (glaciated).



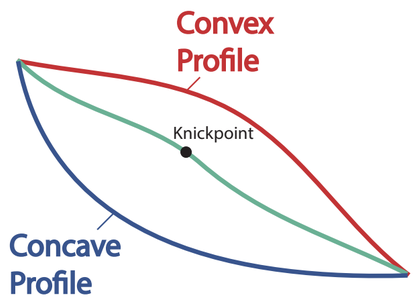
Hypsometry

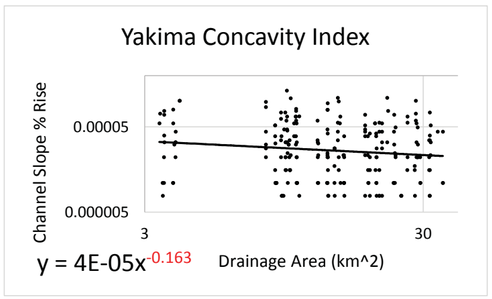
Hypsometry is a measure of the relationship between area in the basin and elevation along with watershed catchment. The shape of a hypsometric curve is an indicator of the dominant geomorphic processes, diffusive or fluvial. A convex curve indicates a watersheds area or volume of rock and soil is located at a higher elevation. This type of curve shows a diffusive process as the dominant geomorphic process and characterizes the landscape as "young". A concave curve indicates the majority of the basins area is locacted at a lower elevation, meaning more material has been removed in higher areas and transported down. This type of curve shows channelized /linear/fluvial/alluvial processes being dominant and suggests an "old" landscape. The pixel count plays a role in hypsometry since they display the pixels of each relative elevation by the bin number, bin 1 has the lowest elevation and bin 100 has the highest. The pixel count shows the quantity of the material in the watershed throughout the range of elevation. The Olympic, Yakima, and Teton watersheds have very similar curvature which could be a result of their lithology hardness. The Rock Springs watershed has a more even distribution indicating a landscape where relatively proportional amounts of erosion and deposition is occurring.

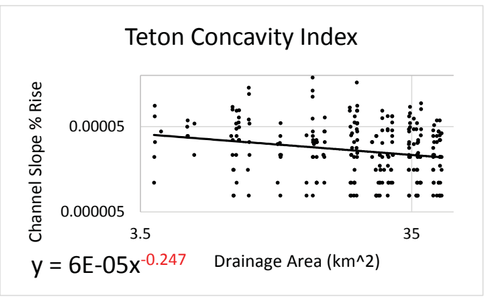


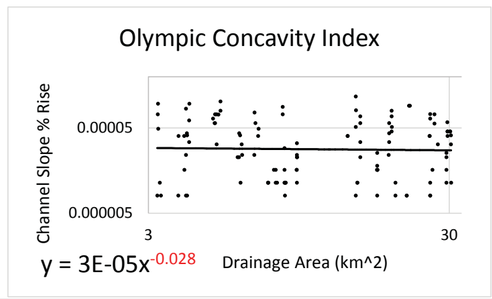
Concavity

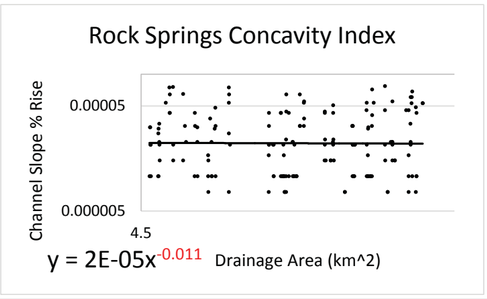
Channel concavity is a measure of the change in slope of a reach. Most longitudinal profiles are concave in nature due to the erosion limiting bedrock at the headwaters and the downstream deposition environment. Of the four watersheds investigated, the Tetons and Rock Springs had the most polarizing concavity indexes which can also been seen in their long profiles.





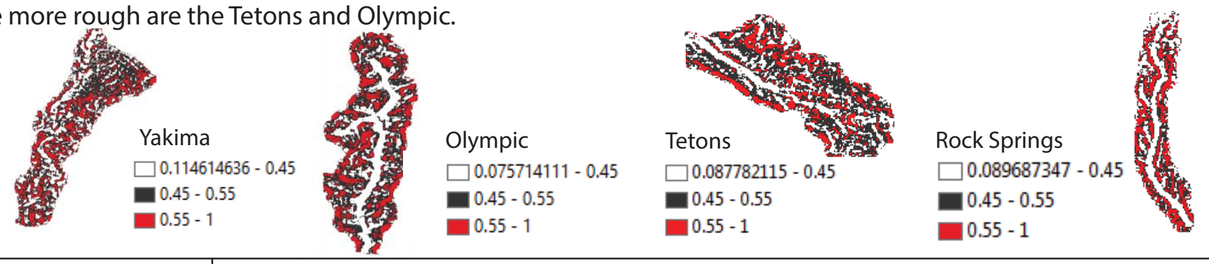






Relative Position Index

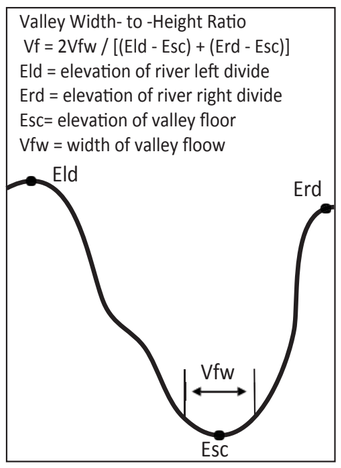
The relative position index is a topographic roughness metric and local elevation index. Each pixel's topographic position is found with respect to its local neighborhood and its relative position. The results are classified as high in red, medium in black, and low in white. Both low and high values represent valley bottoms and ridge tops. The medium values represent the transition between the high and low elevations, essentially the ruggedness of the terrain. Each watershed has some degree of roughness, but the watersheds that appear to be more rough are the Tetons and Olympic.



Valley Width-To-Height Ratio

The valley width-to-height Ratio (Vf) allows the comparison of erosional patterns between watersheds. A low valley width-to-height ratio is most common in areas of active uplift and linear stream incision. A high valley width- to -height ratio suggests a tectonically stable area with wider stream valleys or areas formerly glaciated.

The watersheds with higher (Vf) ratios were Yakima with a (Vf)= 1.14 and Rock Springs (Vf) = 1.47. The two watersheds with the lower (Vf) ratios are Olympic with (Vf) = 0.38 and Tetons with a (vf)= 0.49. The Tetons are known to be formally glaciated however its ratio was somewhat higher and suggested that the ratio supports this area being formally glaciated along with stream incision.



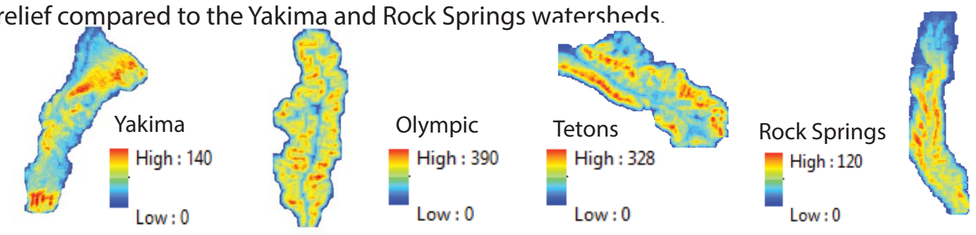
Sinuosity Index

Sinuosity is the level of curvature a stream has. A low values represents a straight stream and a high value represents a sinuous to meandering channel. It is found by dividing the distance down the center of a channel by the straight line distance of a channel.

Sinuosity	
Rock Springs	1.16
Tetons	1.11
Olympic	1.19
Yakima	1.22

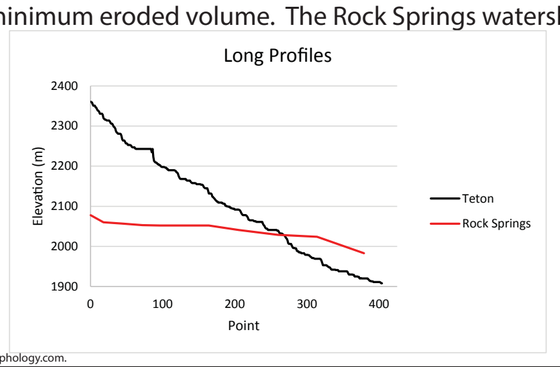
Local Relief

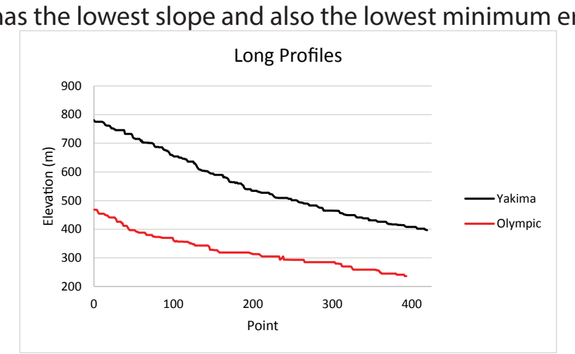
Local relief applies the principles of relief a single pixel by evaluating its 15X15 pixel neighborhood. This creates an image depicting areas of steep terrain (high relief) or moderate terrain (low relief). The Tetons and Olympic watersheds have a higher local relief compared to the Yakima and Rock Springs watersheds.



Long Profile

A longitudinal profile provides a visual representation of a stream's gradient. It can be used as a general assessment of stream power and erosional capacity. The Tetons watershed has the greatest slope and subsequently the greatest minimum eroded volume. The Olympic watershed has the 2nd steepest slope and also the 2nd highest minimum eroded volume. The Yakima watershed is represented by a relatively gentle slope and a low minimum eroded volume. The Rock Springs watershed has the lowest slope and also the lowest minimum eroded volume.





Minimum Eroded Volume

The minimum eroded volume is the difference between the cap of the filled watershed and the terrain's level. A low eroded value would suggest low erosion rates and little erosional uplift or young erosional history. Whereas a high value would suggest high erosion rates and erosional uplift or an older erosional history. The Rock Springs watershed is in a non-glaciated area which would explain why it has the lowest eroded volume. The Yakima watershed also had a lower eroded volume value due to its location in a dry climate. These low values suggest both the Rock Springs and the Yakima watershed have a younger erosional history. Whereas the Olympic watershed is located in a wet climate and had a higher eroded volume similar to the Tetons watershed which is located in a glaciated area. Both of these watersheds' high erosion values suggest an older erosional history.

Watershed	Area (square km)	Volume (cubic km)
Rocksprings	9273.2	0.74
Tetons	8979.5	8.5
Olympic	8382.7	7.026
Yakima	8538.6	0.92

Information and figures modified from www.gis4geomorphology.com.