Name(s)

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Project Number

S0917

Project Title

Sierra Streams: The Effect of Glacial Melt on Fall Flow

Abstract

Objectives

I was curious to see if watersheds with melting glaciers would have a greater early fall streamflow than watersheds without glaciers.

Methods

I selected study areas in Glacier Creek, Virginia Creek, and Walker Creek watersheds in the Sierra Nevada mountains, ranging from 3000m to 4000m in elevation. Dana Glacier contributes to flow in Glacier Creek because it is melting, having lost 85% of its volume since 1883. My other two watersheds did not have glaciers. I spent over 20 hours learning to use GIS, a complex geographical analysis program, to analyze area and elevation to select watersheds with similar profiles. I measured streamflow in September after the winter snowpack had melted. I hiked 2-9 miles to each site and used the salt conductivity method to measure streamflow. This method is generally used in small turbulent alpine creeks without a consistent cross-sectional area. To determine streamflow, I poured a known amount of saltwater into my stream and measured the change in conductivity over time. I then preformed a controlled calibration experiment to find the relationship between dilution and conductivity. With all of my data from the field I created an analysis spreadsheet and used a complex mathematical equation to calculate streamflow.

Results

I found that Glacier Creek had the largest streamflow of 2.7 cubic feet per second (cfs), Walker Creek had a streamflow of 0.2 cfs, and Virginia Creek had a streamflow of 0.7 cfs. Glacier Creek was 10.7 times larger than Walker Creek, and 3.5 times larger than Virginia Creek. I normalized my results and Virginia and Walker Creek's streamflow only changed by 0.04 cfs or less. These results are consistent with my observations in the field.

Conclusions

Dana Glacier melt was the only significantly different contributor to streamflow in my watersheds and is the cause of higher flow in Glacier Creek. This indicates that my hypothesis was correct. Glaciers all across the world are melting away, which will have significant effects on the plants and animals that depend on the environments glacial melt streams currently support. Streamflow will significantly reduce in early fall, so people need to begin adapting cities and agriculture for a drastically different future. Due to climate change it is too late to save glaciers but if we take immediate action to curb our carbon emissions, we can preserve much of the wintertime snowpack.

Summary Statement

I measured streamflow in three similar high altitude Sierra watersheds using the salt dilution method and found that one watershed had a significantly larger early fall streamflow due to glacial melt.

Help Received

Thank you to Dr. Connie Millar for being my science advisor. Thanks to Dr. Greg Stock who helped me with the procedure for the salt dilution method. Also to Maureen McGlinchey for helping me learn and use GIS. Thanks to Geoff McQuilkin (my dad) for help in the field and with data analysis.