Projecting Disappearance of the Dana Glacier Using Observed Melt Rate and 3D Modeling

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The Dana Glacier, a small Little Ice Age cirque glacier in the Sierra Nevada mountains, is rapidly retreating due to climate change. To predict when the Dana Glacier will disappear, I measured melt of the glacier in the field and used that information to construct a 3D model in ArcGIS Pro to project future melted glacier surfaces. In July 2021, I acquired a science study permit and assembled a research team. We hiked 10 miles roundtrip to the Dana Glacier and placed 8 ablation poles. Each 5-meter ablation pole was placed into holes drilled 5 m into ice with an ice auger. As the ice melted, the pole remained fixed in place. On August 29, we resurveyed all 8 ablation poles. The vertical melt of the Dana Glacier over the study period ranged from 1 to 3 meters, which I extrapolated for the full 2021 melt season to be an average of 5 meters. To determine the extent of the Dana Glacier's melt over a longer time scale, I used ArcGIS Pro and historical photography to digitally construct glacier surfaces from 1883 and 1960. I found that the current volume of the Dana Glacier is just 6% of that in 1883. To project future surfaces of the Dana Glacier, I interpolated a 3D map of annual melt across the glacier surface in a 3m grid. I lowered the current ice surface by subtracting the melt layer. Using the newly calculated surface, I repeated the process until the glacier disappeared. I found that if the next six years have a melt rate similar to 2021, the majority of the Dana Glacier will have melted away by 2027. When the Dana Glacier melts away, the environment it supports will suffer. Glaciers are sensitive indicators of the climate; the melt and projected rapid disappearance of the Dana Glacier directly reveals that climate change is irreversibly impacting the natural world.

Awards Won:

Fourth Award of $500

National Oceanic and Atmospheric Administration - NOAA: Judges' Award