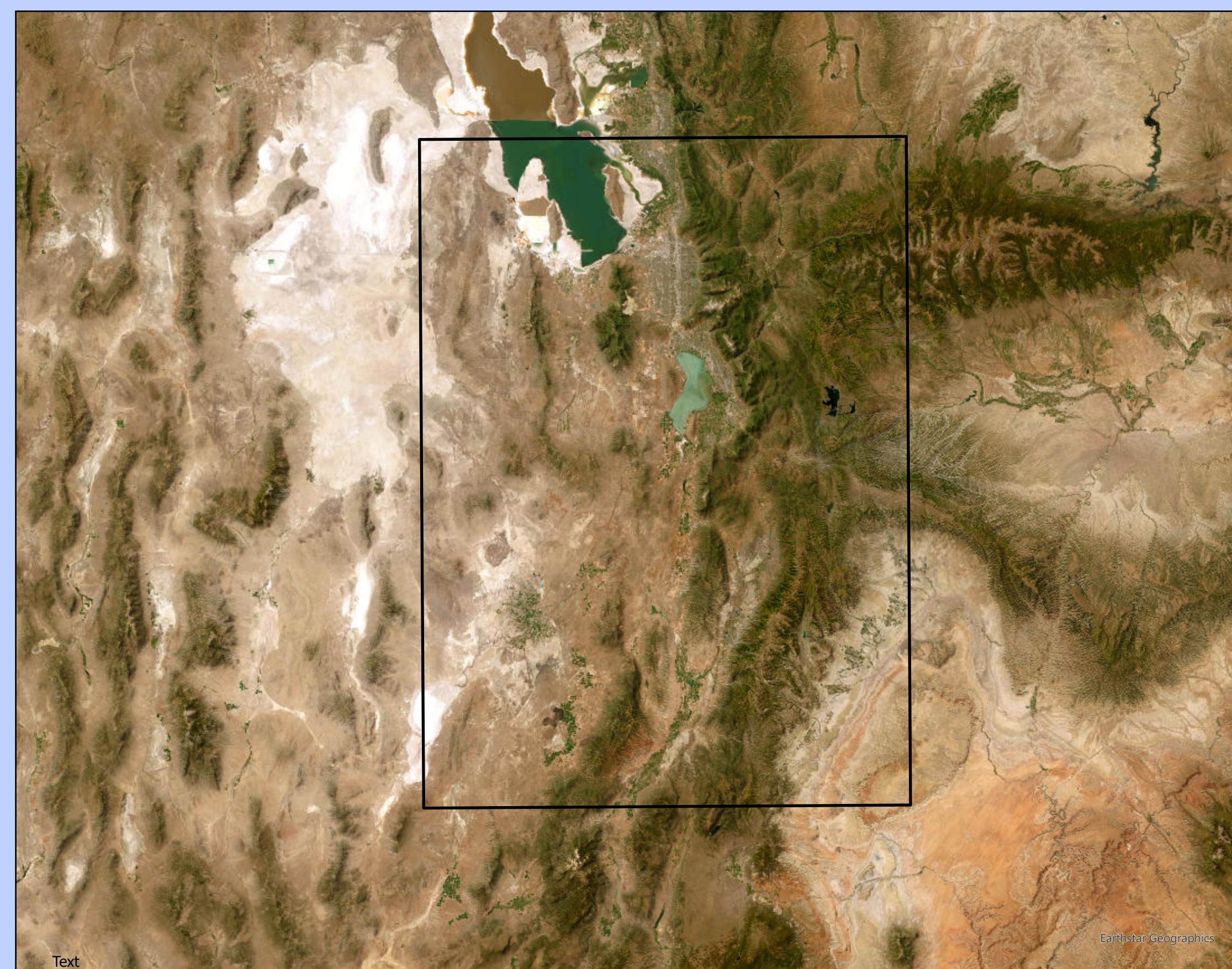


Estimating Effective Grain Size Over The Wasatch Front Snowpack Using Landsat-OLI

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Area of Interest



Project Goal: Seasonal Snowpack is important for the communities along the Wasatch Front because it greatly contributes to the water level of The Great Salt Lake and general water supply of Utah. The snowpack is affected by warming and also by the deposition of dust and other aerosols on the surface. We plan to derive information using satellite imagery. A big step in finding this increased warming is finding the effective grain size of the snow, this has been done before using Moderate Resolution Imaging Spectro radiometer (MODIS) data but my intention is to try and get the snow grain size using Landsat-OLI . The snow absorption depending on the size of grain

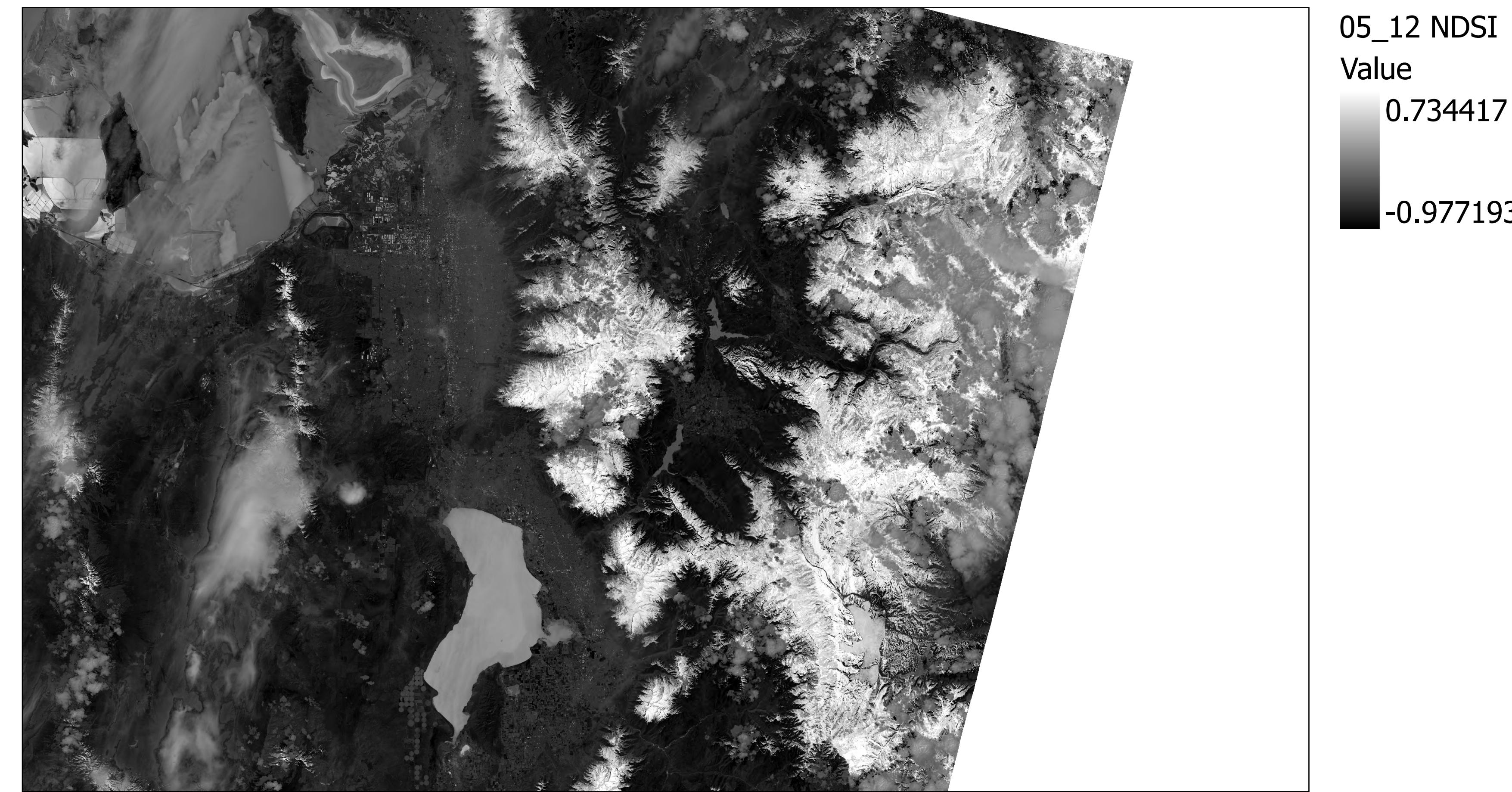


FIG 1: Landsat 9 -OLI image taken 05/12/2023 after the NDSI was performed and before the snow mask to show the contrast.

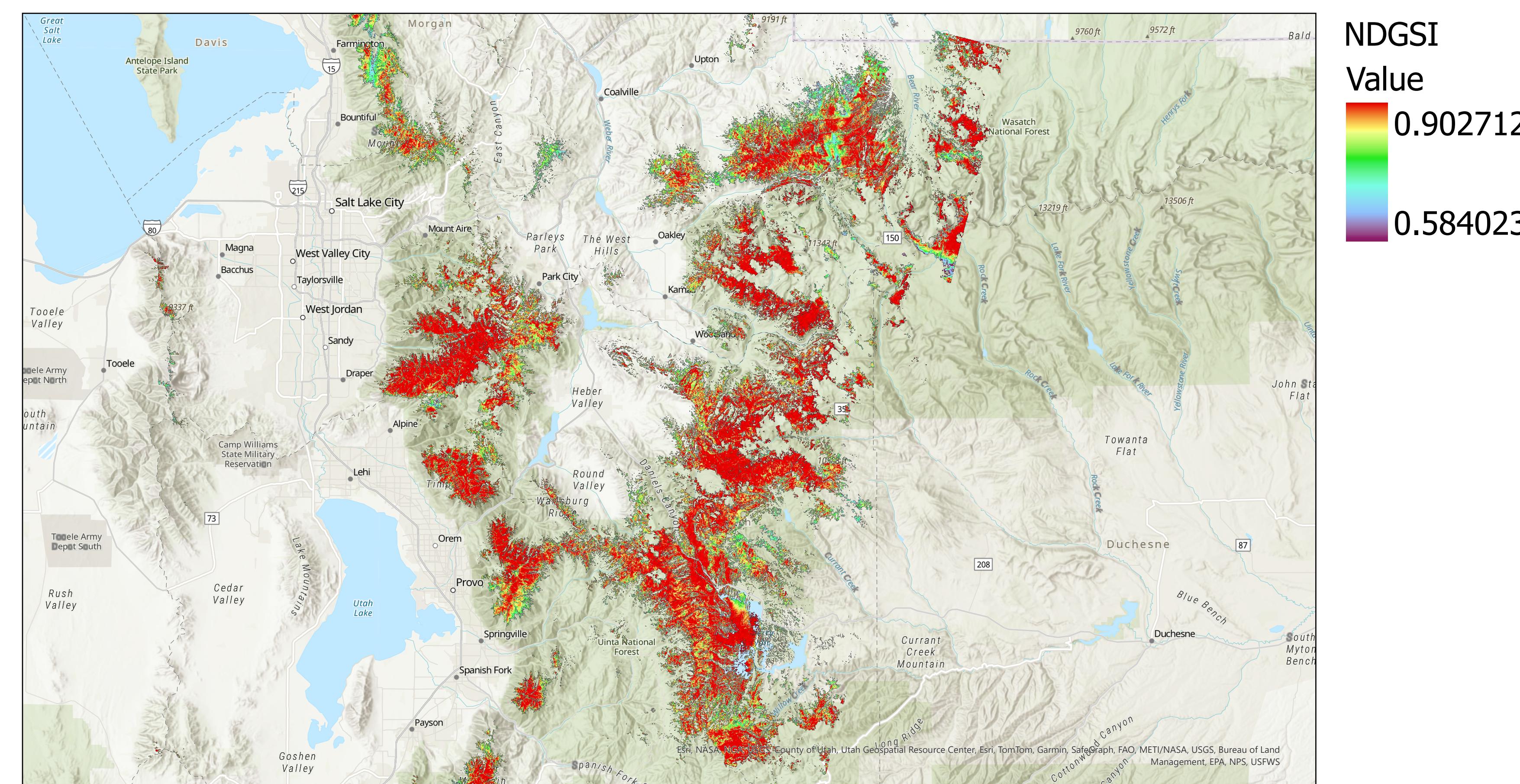


FIG 2: After extracting by NDSI mask create the NDGSI which has values can be used calculate that can estimate snow grain size.

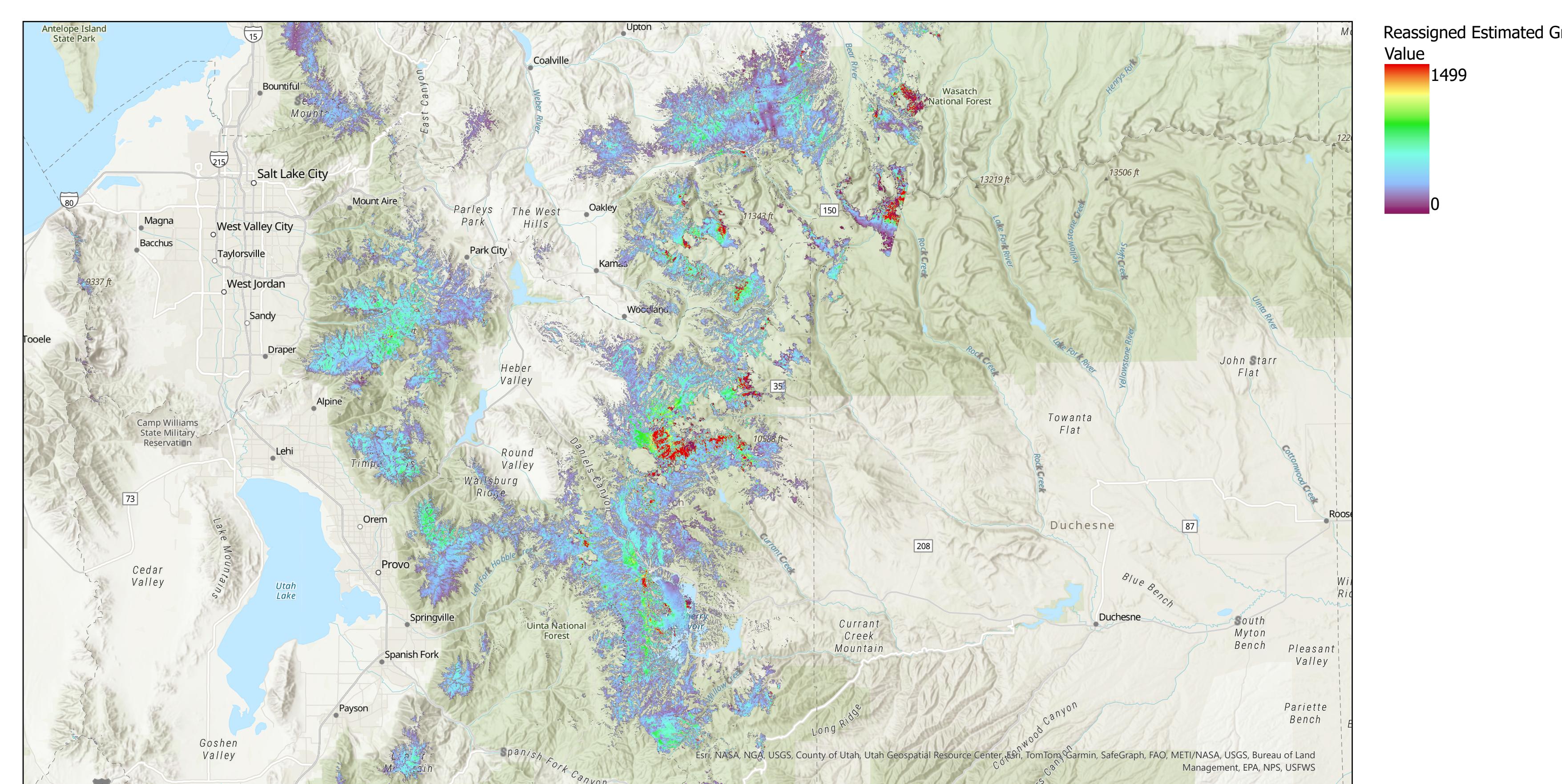


Fig 3: After reassignment, estimated grain size from 1-1500 and using the values to my NDGSI on May 12th, 2023

Results

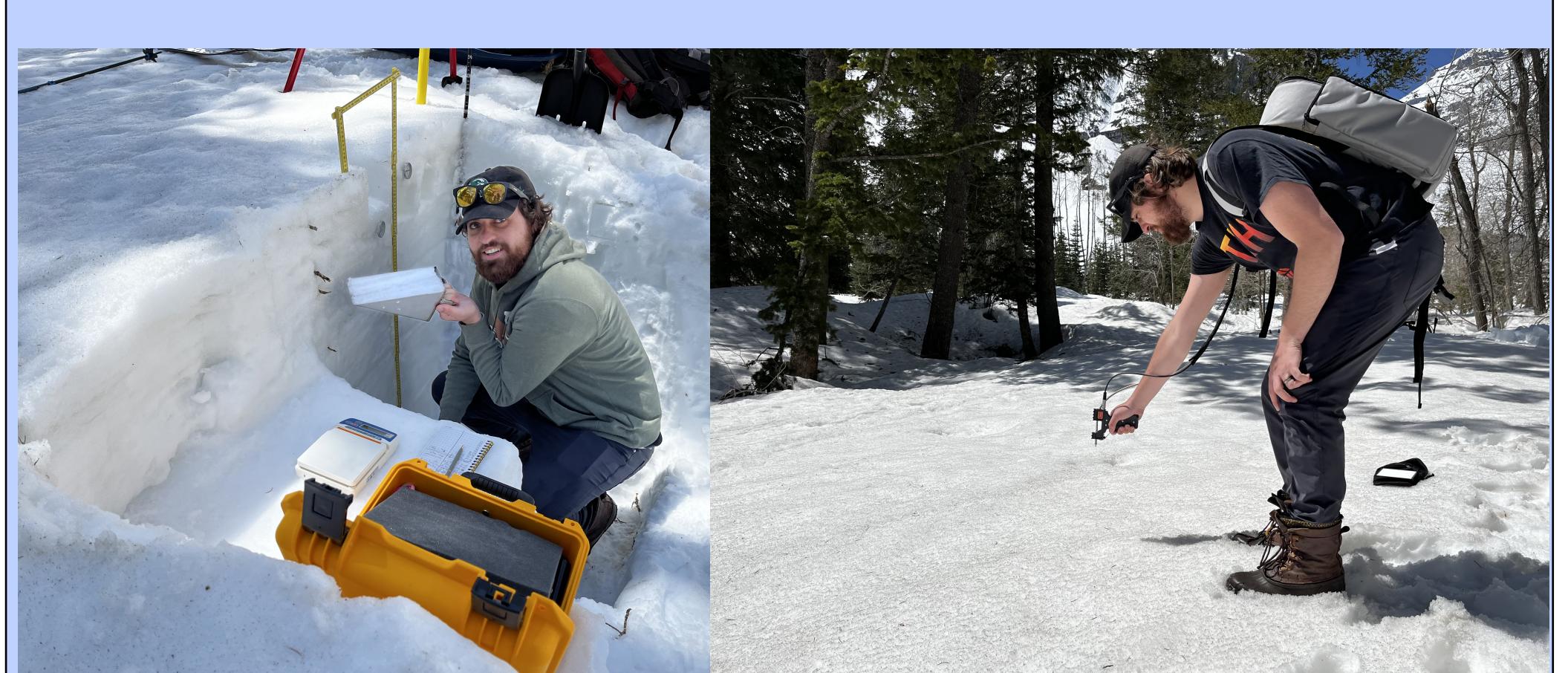
The NDSI was successful in filtering out the clouds and made for a more accurate assessment of the snow, the NGDSI was done previously with another image in April of 2023 but because it was all fresh snow when the image was taken the grain size only went from 30-34. Because May 12th was late in the season the grain size varied and got some areas with a very large size up to 1400. This experiment ended up helping us understand more about the workflow that is needed to find the grain size and to see if we can use Arc GIS Pro to estimate the grain size of Landsat- OLI images, and puts us one big step closer to finding the radiative forcing of these images to have a better analysis of the dust deposit in our snowpack.

There was no accuracy assessment done because that would need to have fieldwork performed, however, there was an accuracy assessment to check if the reassigning of values was done successfully. There is likely a correlation with elevation and grain size and we can pair the last image with a Digital Elevation Model(DEM).

Future Work

In the future we will use the same workflow that we learned with this project to get closer to Calculate "radiative forcing" to understand better how much dust is in our snowpack. Also performing accuracy assessments of the grain size reassignment to see how accurate the NDGSI will be for future projects that depend on accuracy of grain size. We plan to compare this scene with other Satellite products that can calculate grain size scene to see if the grain sizes relatively match. We also plan on doing some field work at a spot at the same time OLI- Landsat passes over to test the accuracy. Here is a photo of some of the field work We have done in the past.

Field Work



Picture taken while doing field work up near Aspen Grove using the field spectrometer and digging a snow pit to process the amount of dust deposited in the snow and measuring grain size

References

- Landsat 9 - OLI
Skiles, S. M., Donahue, C. P., Hunsaker, A. G., & Jacobs, J. M. (2023). UAV hyperspectral imaging for multiscale assessment of Landsat 9 snow grain size and albedo. *Frontiers in Remote Sensing*, 3, 1038287. <https://doi.org/10.3389/frsen.2022.1038287>
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