

**Investigating the Effect of Changing Precipitation, Snowpack, and River Ice Patterns on
the Hydrology and Geomorphology of Maine Rivers
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As temperatures rise due to climate change, the timing and presence of ice and snow melt are changing, which in turn greatly affects river processes. Previous studies have shown that river ice is forming later and breaking up earlier, which has broader implications for the ecological and geomorphic (meaning the processes by which rivers are shaped through the movement of water) functioning of rivers - potentially including changes to sediment transport and nutrient availability. Additionally, climate change is causing an increase in the frequency and intensity of precipitation and other extreme weather events, which is especially relevant to our position here on the coast of Maine. The resulting higher flows and floods endanger human lives and damage infrastructure, while also altering the hydrology of a stream resulting in a loss in healthy ecological function.

In order to better understand how snowpack and river ice is changing due to global warming, I fine-tuned a method to classify Landsat imagery, a type of satellite imagery which can be downloaded directly from the USGS website. By first uploading these images to QGIS and running supervised and unsupervised classifications, I was able to discern which spectral bands of the images are needed in order for the software to best differentiate various land classes in the images. After spending some time learning the basics of coding in R, I used the Terra and Rpart packages in order to create a code for unsupervised and supervised classification methods and deduce which was the most effective. Despite requiring more time and human input I found that supervised classifications were the most effective, and I was able to classify land type in the Sheepscot watershed for the 2023-2024 winter with 93% accuracy. In the future, my code will be used over a longer time span in order to understand how climate change has affected the timing of snow and ice formation and breakup across different watersheds in Maine.

Another aspect of my research this summer was doing work in the field focused on studying sediment transport in the Sheepscot and how it is affected by river ice and flooding events. Our team collected sediment from two transects of the Sheepscot river (representative of the proportion of each size of sediment which was in the river), used a rock saw to cut them open and tag them with RFID tags – which uniquely identify each sediment grain, seal them then paint them and assign unique numbers to them. Finally, we returned them to the river so that we can track how they travel during the wintertime and in future flood events using a scanner device.

The R methods I developed this summer and the preliminary knowledge about the Sheepscot we gathered including setting up the sediment transport study marks the start of Professor Jabari Jones' Maine Rivers Project. In the future, this project will expand beyond our focus on the Sheepscot watershed to look at the effects of climate change on the hydrology and geomorphology of rivers across Maine.

Faculty Mentor: Jabari Jones

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