Julia Olson

New Hampshire Space Grant, Fall 2022 Report

As an M.S. candidate in Hydrology in the Earth Sciences Department at the University of New Hampshire, I am working with Alix Contosta and Liz Burakowski to study changing winters and their impact on springtime vegetation ecology and hydrology in the Teton Range in WY. My work uses both ground and remote sensing snow and phenology data, as well as soil moisture and streamflow data, to explore the time between snowmelt and vegetation green-up, known as the vernal window. In the fall of 2022, New Hampshire Space Grant funding allowed me to spend more time on data collection and analysis in this research.

During the grant award period, I focused mostly on analyzing remote sensing data and calibrating data collection instruments installed for this project to improve their function.

I used remote sensing data from NASA Landsat Missions 5 and 8, accessed through Google Earth Engine, were to find snow cover and vegetation greenness across the whole study area over time. This involved trimming the spectral variables, or bands, from the Landsat data to the study area, masking clouds in the data, and then finding Normalized Snow Difference Snow Index (NDSI) and the Normalized Difference Vegetation Index (NDVI), indications of snow cover and vegetation greenness, respectively. I then calculated snow disappearance date, defined as the date on which NDSI was less than or equal to 0, and after which there were no days when NDSI was greater than 0. Remote-sense vegetation green-up date was calculated by fitting a harmonic curve to the NDVI data and calculating the date on which 33% of the fitted annual amplitude of greenness (NDVI) was achieved. From this work, I mapped snow disappearance date and vegetation green-up date, as well as vernal window length, for the whole study area. I found that snow disappearance and green-up tend to occur later at higher elevations, and that green-up often occurs before snow disappearance at high elevations (called a negative vernal window) (Figure 1).

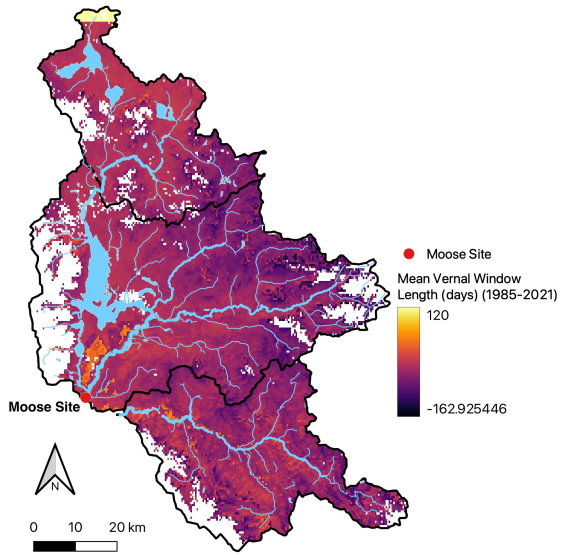

Figure 1: Study area with vernal window length calculated from Landsat 5 and 8 remote sensing data. White areas represent areas where there is no vernal window (i.e., snow does not melt all year or there is no vegetation). At high elevations, vernal window may be negative (vegetation greens-up before snow disappears).

Additionally, the increased time spent on research work afforded by the NHSG funds allowed me to visit my field sites during the funding period and repair data collection instruments. At UNH, I worked on a previously installed A MaxBotix MB7364, HRXL-MaxSonar-WRS snow depth sensor that had recorded unexpectedly noisy data the previous winter. I was able to modify the code and hardware to hopefully fix that issue. I travelled to my field site in Moose, WY, and re-installed the sensor, and it is now successfully collecting snow depth data.

Overall, I would not have made the progress on my research that I did without NHSG funding, as the fellowship allowed me to allot large periods of time during my week to analysis and gave me the freedom to travel to my field sites. I am grateful for the experience and learned so much.