Mapping Arctic Vegetation using Hyperspectral Airborne Remote Sensing Data

Shashank Konduri[1], Jitendra Kumar[2], Forrest Hoffman[1*], and William Hargrove[3]

[1]Computational Sciences and Engineering Division, Oak Ridge National Laboratory, Oak Ridge, TN
[2]Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN
[3]US Forest Service, Southern Research Station, Asheville, NC

Contact: (konduriv@ornl.gov)
Project Lead Principle Investigator (PI): Stan Wullschleger BER Program: TES
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Project Website: https://ngee-arctic.ornl.gov

Amplified warming in the circumpolar Arctic has led to shifts in vegetation composition, increased shrubification and northward expansion of tree line. Changes in Arctic vegetation cover and composition are likely to have a significant impact on tundra ecosystem function through changes in hydrological regimes, energy exchange, and carbon and nitrogen cycling. Understanding the current composition and distribution of vegetation is essential for studying this sensitive ecosystem and predicting responses to environmental change. Mapping Arctic vegetation from coarse spectral- and spatial-resolution satellite remote sensing data is challenging because of poor image quality due to persistent cloud cover and polar darkness, in addition to the high diversity and heterogeneity of vegetation. Our analysis is focused on the Seward Peninsula of Alaska, where the US Department of Energy's Next Generation Ecosystem Experiments for the Arctic (NGEE Arctic) project is conducting in situ measurements. Using airborne hyperspectral remote sensing data from NASA AVIRIS-NG and satellite remote sensing platforms, we are developing high resolution maps of vegetation community distribution and estimates of fractional plant functional type (PFT) distributions for models. We are developing and applying deep learning models, trained using field-based vegetation community survey observations, for remote sensing-based classification of vegetation communities. High resolution maps of vegetation for Seward Peninsula will be used to understand environmental controls on patterns of vegetation distribution on the landscape, while estimates of PFT distributions will inform and improve the representation of vegetation dynamics in Earth system models.