

## Patterns and Drivers of Alder Distribution Across a Tundra Landscape at Seward Peninsula

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Arctic regions have exhibited a greening trend and rapid expansion of deciduous shrubs across previously graminoid-dominated tundra vegetation communities. Among tundra shrub species, Alders (*Alnus*) are of key interest due to their ability to fix biologically available nitrogen to the ecosystem via symbiotic nitrogen fixation. *Frankia alni* bacteria living within Alder root nodules fix nitrogen in exchange for plant-produced carbohydrates. As an early successional species, Alders often colonize disturbed areas with low levels of nitrogen availability such as river and stream floodplains, fire burned areas, and cryoturbated mineral soils. Their significant contribution to high latitude greening highlights the need for understanding their current distribution across tundra landscapes and environmental conditions supporting their expansion and establishment. Using a machine learning-based approach we are analyzing high resolution satellite remote sensing data set to understand the current distribution of Alder shrubs across the Seward Peninsula of Alaska, where the US Department of Energy's Next Generation Ecosystem Experiments (NGEE) Arctic project is conducting field, laboratory and modeling-based studies. Using field observations collected during the 2017–2019 field seasons, we are training deep learning models to classify the current distribution of Alder shrubs across the topographically complex landscape. By analyzing the topographic, hydrological, edaphic and micro-climatic conditions in the regions of known Alder presence, we are investigating the patterns of Alder expansion and establishment. As the vast Arctic tundra landscape experiences a warming climate, understanding the drivers of Alder expansion and establishment will inform predictions of potential regions where shrubification may occur. With its ability to fix nitrogen, Alders also modulate the nutrient cycle and vegetation communities in the broader landscape. Our research will also shed light on the biogeochemical impacts of Alders on tundra ecosystems.