

Poster #1-6

Next-Generation Ecosystems Experiment (NGEE Arctic): Progress and Plans

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The Next-Generation Ecosystem Experiments (NGEE Arctic) project seeks to improve the representation of tundra ecosystems in Earth System Models (ESMs) through a coordinated series of model-inspired investigations conducted in landscapes near Utqiagvik (formerly Barrow) and Nome, Alaska. In Phase 1 (2012 to 2014), we tested and applied a multiscale measurement and modeling framework in a coastal tundra ecosystem on the North Slope of Alaska. In Phase 2 (2015 to 2019), three additional field sites were established on the Seward Peninsula in western Alaska. Integrated field, laboratory, and modeling tasks allowed our team to focus on understanding (1) the effect of landscape structure on the storage and flux of C, water, and nutrients, (2) geochemical mechanisms responsible for CO₂ and CH₄ fluxes across a range of permafrost conditions, (3) variation in plant functional traits across space and time, and in response to changing environmental conditions and resulting consequences for ecosystem processes, (4) controls on shrub distribution and associated biogeochemical and biophysical climate feedbacks, and (5) changes in snow processes and surface and groundwater hydrology expected with warming in the 21st century. A major outcome of our Phase 1 and 2 research was an integrated set of in situ and remotely sensed observations that quantify the covariation of hydro-thermal, ecosystem, vegetation dynamics, and biogeochemical function. In Phase 3 (2020 to 2022), we propose to continue our research at sites on the North Slope and in western Alaska, while also adding a cross-cutting component on disturbance. We will use field campaigns, modeling, and data synthesis to target improvements in simulating disturbance-related processes (e.g., wildfire and abrupt permafrost thaw) and connections to dynamic vegetation (e.g., shrubs) that are missing from or poorly represented in ESMs. Our vision in Phase 3 strengthens the connection between process studies in Arctic ecosystems and high-resolution landscape modeling and scaling strategies developed in Phases 1 and 2. Safety, national and international collaboration, and a commitment to project management continue to be key underpinnings of our model-inspired research in the Arctic.