

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

Stan Wullschleger^{1*}, Tom Boden¹, Robert Bolton⁵, David Graham¹, Susan Hubbard³, Colleen Iversen¹, Alistair Rogers⁴, Vladimir Romanovsky⁵, Joel Rowland², Peter Thornton¹, Margaret Torn³, William Riley³, and Cathy Wilson²

¹ Oak Ridge National Laboratory, Oak Ridge, TN

² Los Alamos National Laboratory, Los Alamos, NM

³ Lawrence Berkeley National Laboratory, Berkeley, CA

⁴ Brookhaven National Laboratory, Upton, NY

⁵ University of Alaska, Fairbanks, AK

(wullschlegsd@ornl.gov)

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The Next-Generation Ecosystem Experiments (NGEE Arctic) project is a decade-long (2012 to 2022) study that seeks to improve the representation of high-latitude ecosystems in Earth System Models (ESM). We are conducting a coordinated series of model-inspired investigations in permafrost landscapes near Barrow (recently renamed Utqiagvik) and Nome, Alaska. In Phase 1 (2012 to 2014), researchers applied a multi-scale measurement and modeling strategy for watersheds on the North Slope of Alaska. Knowledge gained on topics ranging from hydrology to plant physiology provided process understanding and parameters that are now being incorporated into DOE's Accelerated Climate Model for Energy (ACME). In Phase 2 (2015 to 2018), we have established three field sites on the Seward Peninsula which, compared to our research site on the North Slope, are characterized by transitional ecosystems; warm, discontinuous permafrost; and well-defined watersheds with strong topographic gradients. These new sites expand our capabilities to investigate (1) landscape structure and controls on the storage and flux of carbon, water, and nutrients, (2) edaphic and geochemical mechanisms responsible for variable 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, (4) controls on shrub distribution and associated climate biogeochemical and biophysical feedbacks to climate, and (5) changes in surface and groundwater hydrology. Our vision in Phase 1, and now extended into Phase 2, strengthens the connection between process studies in Arctic ecosystems and high-resolution landscape modeling and scaling strategies. The NGEE Arctic project supports the BER mission to advance a robust predictive understanding of Earth's climate and environmental systems. The research conducted by NGEE Arctic is coordinated with the NASA Arctic-Boreal Vulnerability Experiment (ABOVE). Safety, collaboration, outreach, and a commitment to data management, sharing, and archiving are key underpinnings of our model-inspired research in the Arctic.