Poster #1-16

Interactions Between Climate Warming and Fire Will Drive Expansion of High-Latitude Deciduous Vegetation

Zelalem Mekonnen[1*], William Riley[1], James Randerson[2], Robert Grant[3], and Brendan Rogers[4]

[1] Climate and Ecosystem Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA;
[2] Department of Earth System Science, University of California, Irvine, CA;
[3] Department of Renewable Resources, University of Alberta, AB, Canada
[4] Woods Hole Research Center, Falmouth, MA

Contact: zmekonnen@lbl.gov

BER Program: TES
Project: NGEE Arctic
Project Website: https://ngee-arctic.ornl.gov/

High-latitude regions have experienced the most rapid warming in recent decades and this trend is projected to continue over the 21st century. Fire is also projected to increase with warming. We show here, consistent with changes during the Holocene, that projected changes in 21st century climate and fire will also alter the modeled composition of Alaskan vegetation. We hypothesize that tradeoffs in competition for nutrients after fire in early succession versus for light later in succession under warmer climate will cause shifts in plant functional types (PFTs). Consistent with observations, evergreens were modeled to be the current dominant PFTs in Alaska. However, under future climate and fire the relative dominance of deciduous PFTs will double from current levels, accounting for 58% of Alaska ecosystem net primary productivity (NPP) by 2100, with commensurate declines in contributions from evergreens and herbaceous plants. Post-fire deciduous PFTs growth under future climate was sustained from enhanced microbial nitrogen mineralization caused by warmer soils and deeper active layers, resulting in taller plants that competed more effectively for light. Expansion of deciduous PFTs will affect the carbon cycle, surface energy fluxes, and ecosystem function, thereby affecting multiple feedbacks with the climate system.