The Berkeley Lab Terrestrial Ecosystem Science SFA on Belowground Biogeochemistry: Five years of deep soil warming

Margaret S. Torn[1*], Eoin Brodie[1], Peter Nico[1], Bill J. Riley[1], Cristina Castanha[1], Rachel C. Porras[1], Jennifer L. Soong[1], Ricardo E. Alves[1], Zhou Lyu[1].

[1]Lawrence Berkeley National Laboratory, Berkeley, CA;

(mstorn@lbl.gov)

BER Program: TES
Project: Berkeley Lab TES SFA on Belowground Biogeochemistry
Project Website: https://eesa.lbl.gov/projects/terrestrial-ecosystem-science/

In the Berkeley Lab Terrestrial Ecosystem Science SFA, we conduct basic research on the role of soils in terrestrial biogeochemistry and the Earth system. Our goals are to improve process-level understanding of ecosystem-climate interactions and to develop next-generation predictive capacity suitable for Earth system models. Current SFA research is centered around a set of field, laboratory, and model experiments to characterize how biotic and abiotic processes influence soil carbon cycling, and how they may shape ecosystem responses to a warming climate. We are conducting a field experiment in a well-drained coniferous forest in which we are warming the whole soil profile (+4ºC) and adding ^{13}C-labelled litter at different soil depths. We are using the experiments to evaluate the influence of soil depth, mineralogy, biota, and climate on soil carbon dynamics, and applying the results and observations to inform model structures and parameters. We are using experimental data from the deep soil warming, incubations, and other studies to guide model development in a reactive transport framework (BeTR; Tang et al. 2013), and integrating this into the DOE E3SM land model (ELM). This poster will present biogeochemistry results from the Blodgett Forest whole soil warming experiment over its first five years. Research on microbiology, mineralogy, and modeling are described in abstracts by Alves, Nico, and Lyu respectively.

During the first two years of the experiment, warming increased total CO_2 respiration by 35% (Hicks Pries et al. 2016). After five years of warming (spanning both wet and drought years), soil respiration continued to average 30% higher compared to the control plots with no trend in the effect size. Decomposition, as measured by soil CO_2 production, was significantly higher in the subsurface (>20 cm depth). Moreover, by year five, we documented a significant decrease in soil carbon stocks due to heating, particularly below 50 cm depth.

Hicks Pries, C.E., C. Castanha, R. Porras, and M.S. Torn. 2017. The whole soil carbon flux in response to warming. *Science* 2017; eaal1319 DOI: 10.1126/science.aal1319