BRC Science Highlight
September 2019

Soil Microclimates Influence Annual Carbon Loss via Heterotrophic Soil Respiration in Maize and Switchgrass Bioenergy Cropping Systems

Background/objective

Plant phenology, plant structure, and litter properties affect the soil microclimate. Soil temperature and moisture regulate ecosystem carbon losses through their effect on heterotrophic respiration (R_H). Here, we quantify differences in soil microclimates and their effect on R_H in maize and switchgrass bioenergy cropping systems.

Approach

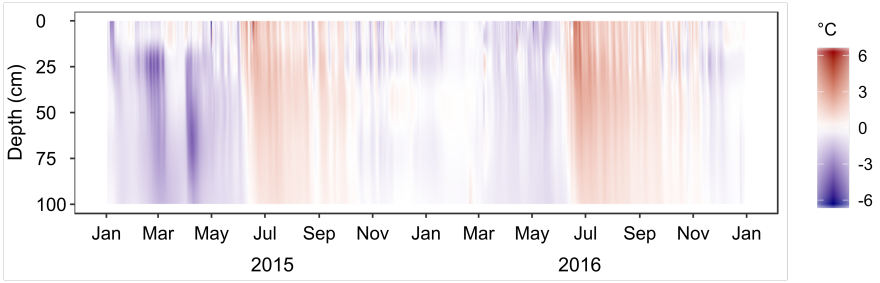
- Measured soil temperature, soil moisture, and R_H
- Modeled R_H under the true microclimate and the microclimate of the other cropping system.

Results

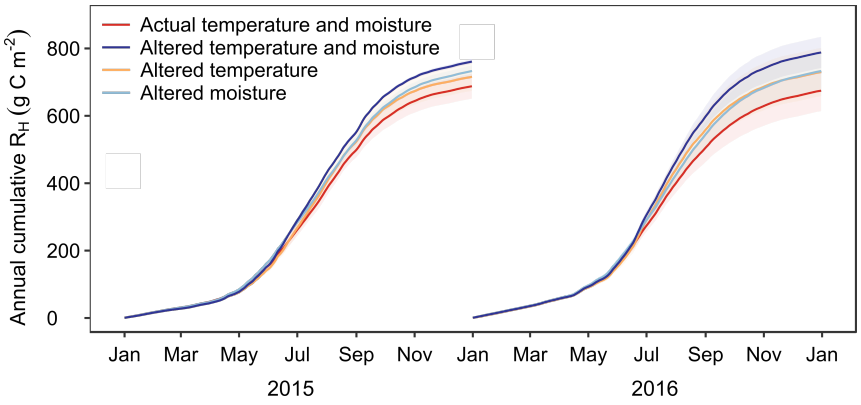
- Summer soil temperatures were warmer in maize than switchgrass, reflecting differences in plant phenology.
- Near-surface soil moisture was lower in maize.
- Soil microclimates differences accounted for 4%-17% of the annual R_H carbon loss, equivalent to 8%-30% of the average annual biomass carbon input into the systems.

Significance

- The soil microclimate represents a link between aboveground properties and belowground carbon cycling.
- Management for cool summertime soil microclimate may help to maintain soil organic carbon in bioenergy systems.



The difference between maize and switchgrass soil temperatures from 0 to 100 cm soil depth. Red shades indicate warmer temperatures in maize, and blue shades indicate warmer temperatures in switchgrass.



Annual cumulative R_H in switchgrass under four soil microclimate scenarios. Red lines represent switchgrass R_H under the switchgrass soil microclimate and blue lines represent switchgrass R_H under the maize microclimate.

von Haden, A.C., et al. 2019. "Soil microclimates influence annual carbon loss via heterotrophic soil respiration in maize and switchgrass bioenergy cropping systems." ***Agricultural and Forest Meteorology****, DOI: 10.1016/j.agrformet.2019.107731.*

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