Geophysical Research Abstracts
Vol. 21, EGU2019-10325, 2019
EGU General Assembly 2019

Long-term fluxes of carbon dioxide from native prairie and managed crop systems in the Midwest United States.

Caitlin Moore (1), Evan Dracup (2), Nuria Gomez-Casanovas (3), Taylor Pederson (4), and Carl Bernacchi (5)

(1) Center for Advanced Bioenergy and Bioproducts Innovation, University of Illinois at Urbana-Champaign, Urbana, United States (caitlinm@illinois.edu), (2) Global change and photosynthesis research unit, United States Department of Agriculture/Agriculture Research Services, Urbana, United States (edracup@illinois.edu), (3) Institute for Genomic Biology, University of Illinois at Urbana-Champaign, Urbana, United States (ngomezca@igb.illinois.edu), (4) Center for Advanced Bioenergy and Bioproducts Innovation, University of Illinois at Urbana-Champaign, Urbana, United States (tpeders2@illinois.edu), (5) Global change and photosynthesis research unit, United States Department of Agriculture/Agriculture Research Services, Urbana, United States (bernacch@illinois.edu)

The establishment of long-term flux monitoring sites is crucial for understanding how climate and biophysical processes influence inter-annual variability in ecosystem structure and function, as well as in greenhouse gas accounting. Annual maize-soybean crop rotations are the dominant land use in the Midwest region of the United States. This system sequesters a large quantity of atmospheric CO_2 in the growing season, but most of this carbon is removed annually and the system remains dormant for a large portion of the year. With the growing push for more sustainable and clean energy sources, alternative perennial biofuel crops, such as miscanthus and switchgrass, are increasing in popularity, and have been shown to retain more ecosystem carbon in their post-growing season structures than traditional annual crop (maize) products. However, little is known about how annual and perennial crops are likely to respond to inter-annual variability in climate and land management practices.

The University of Illinois at Urbana-Champaign has been operating eddy covariance flux towers over four key food and biofuel ecosystems since 2008; a maize-soy rotation, miscanthus, switchgrass and native prairie. During this time, the sites have been subject to climate extremes, including drought and high rainfall years. After renewed data processing and standardization, our results show that annual maize-soy crops respond very differently to perennial crops and native prairie in response to climate extremes. Due to their dynamic year-to-year nature, annual crop productivity recovered faster from climate extremes (i.e. drought) than the two perennial crops. Net carbon fluxes from both miscanthus and switchgrass remained lower than previous years following the impact of a drought in 2012. In contrast to the perennial crops, the native prairie behaved more like the annual maize-soy crop, in that its productivity recovered quickly after the 2012 drought. Our results highlight the impact that climate extremes can have on the greenhouse gas budget of managed ecosystems in the key agricultural food region of the United States.