Geophysical Research Abstracts
Vol. 15, EGU2013-597, 2013
EGU General Assembly 2013

How muti-year manipulation of precipitation influence net primary production and soil CO_2 efflux in a desert grassland

Rodrigo Vargas (1), Scott Collins (2), Michell Thomey (2), Jennifer Johnson (2), Renee Brown (2), Donald Natvig (2), and Michael Friggens (2)

(1) Department of Plant and Soil Sciences, University of Delaware, Newark, United States (rvargas@udel.edu), (2) Department of Biology, University of New Mexico, Albuquerque, USA

Climate models suggest that extreme rainfall events will become more common with increased atmospheric warming. Consequently, changes in the size and frequency of rainfall will influence biophysical drivers that regulate aboveground net primary production (ANPP) and the strength and timing of soil CO_2 efflux -a major source of terrestrial carbon flux. We used a multi-year (5 years) rainfall manipulation experiment where during the summer monsoon season (July-September) size and frequency of precipitation were manipulated in an arid grassland: two years before and three years after a lightning-caused wildfire. ANPP and soil CO_2 efflux rates were always higher under increased rainfall event size than under increased rainfall event frequency, or ambient precipitation. Although fire reduced soil CO_2 efflux rates by nearly 70%, the overall responses to rainfall variability were consistent before and after the fire. Increased rainfall event size enhanced the synchrony between photosynthetically active radiation and soil CO_2 efflux over the growing season before and after fire, suggesting a change in the temporal availability of substrate pools that regulate the temporal dynamics and magnitude of soil CO_2 efflux. We conclude that arid grasslands are capable of rapidly increasing and maintaining high ANPP and soil CO_2 efflux rates in response to increased rainfall event size more than increased rainfall event frequency both before and after a fire. Therefore, the amount and pattern of multiple rain pulses over the growing season are crucial for understanding CO_2 dynamics in burned and unburned water-limited ecosystems.