Geophysical Research Abstracts
Vol. 12, EGU2010-632, 2010
EGU General Assembly 2010

Trajectories of grassland ecosystem change in response to experimental manipulations of precipitation

Alan Knapp (1), Melinda Smith (2), Scott Collins (3), John Blair (4), and John Briggs (5)

(1) Colorado State University, Ft. Collins, Colorado USA (aknapp@colostate.edu), (2) Yale University, New Haven, Connecticut USA (melinda.smith@yale.edu), (3) University of New Mexico, Albuquerque, New Mexico USA (scollins@sevilleta.unm.edu), (4) Kansas State University, Manhattan, Kansas USA (jblair@ksu.edu), (5) Kansas State University, Manhattan, Kansas USA (jbriggs1@ksu.edu)

Understanding and predicting the dynamics of ecological systems has always been central to Ecology. Today, ecologists recognize that in addition to natural and human-caused disturbances, a fundamentally different type of ecosystem change is being driven by the combined and cumulative effects of anthropogenic activities affecting earth's climate and biogeochemical cycles. This type of change is historically unprecedented in magnitude, and as a consequence, such alterations are leading to trajectories of change in ecological responses that differ radically from those observed in the past. Through both short- and long-term experiments, we have been trying to better understand the mechanisms and consequences of ecological change in grassland ecosystems likely to result from changes in precipitation regimes. We have manipulated a key resource for most grasslands (water) and modulators of water availability (temperature) in field experiments that vary from 1-17 years in duration, and used even longer-term monitoring data from the Konza Prairie LTER program to assess how grassland communities and ecosystems will respond to changes in water availability.

Trajectories of change in aboveground net primary production (ANPP) in sites subjected to 17 years of soil water augmentation were strongly non-linear with a marked increase in the stimulation of ANPP after year 8 (from 25% to 65%). Lags in alterations in grassland community composition are posited to be responsible for the form of this trajectory of change. In contrast, responses in ANPP to chronic increases in soil moisture variability appear to have decreased over a 10-yr period of manipulation, although the net effects of more variable precipitation inputs were to reduce ANPP, alter the genetic structure of the dominant grass species, increase soil nitrogen availability and reduce soil respiration. The loss of sensitivity to increased resource variability was not reflected in adjacent plots where precipitation was manipulated for only a single year. And when similar short-term experimental manipulations of precipitation variability were conducted in more arid grasslands, responses in ANPP were opposite those in mesic grassland. This suggests that grassland responses to alterations in precipitation inputs may vary dramatically depending on the long-term hydrologic regime.