

PROJECT ABSTRACT

Title of proposal: Net Ecosystem Carbon and Water Vapor Exchange of Tallgrass Prairie: Component Fluxes and Spatial Heterogeneity

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Note: the first year of this proposal (9/1/05 to 8/31/06) was funded by the NIGEC Regional Center in Lincoln, NE. This proposal requests the second year of funding for this project.

Project Abstract

Rationale and Broad Objectives: Data from a network of eddy covariance (EC) towers has shown that grazing management has a marked effect on the carbon and water balances of tallgrass prairie. However, the impact of grazing is confounded by seasonal and interannual variations in environmental factors, especially the timing and amount of precipitation. Furthermore, spatial variation in fluxes across the landscape makes it difficult to estimate carbon balances at scales larger than the sampling footprint of the flux towers. This project will continue EC measurements of carbon and water vapor fluxes on grazed and ungrazed tallgrass prairie. New work will focus on spatial heterogeneity of fluxes to improve carbon balance estimates at larger scales.

Location: Experiments will be conducted at the Rannells Flint Hills Prairie Preserve, a tallgrass prairie south of Manhattan, Kansas.

Hypotheses:

Grazing will alter fluxes of carbon, water, and energy from tallgrass prairie compared to ungrazed.

However, grazing-induced reductions in canopy photosynthesis will be offset by decreases in ecosystem respiration.

Grazing will alter leaf age distribution and phenology of the canopy which may affect photosynthetic capacity and the seasonal duration of CO₂ fixation.

Variations in soil respiration across the landscape demonstrate temporal stability, a characteristic that may allow improved estimates of respiration at larger scales.

Estimates of the annual carbon balance of tallgrass prairie can be improved with better measurements of carbon losses/storage in animals, from more precise measurements of losses during burning, and by partitioning carbon movement into component fluxes (respiration, gross photosynthesis, etc.)

Methods: Fluxes will be monitored under three different land-management regimes: (1) burned annually, not grazed; (2) burned annually and grazed over the entire growing season, and (3) burned annually and grazed intensively-early in the growing season. Continuous measurements of CO₂, water vapor, and energy fluxes will be made using existing open-path EC towers. Automated chambers will provide hourly measurements of total ecosystem respiration. To address spatial variation, soil respiration will be measured at points on transects across the same pastures sampled with the eddy-covariance towers. These data will be used to test for temporal stability.

Expected Outcomes and Deliverables: Research will contribute to regional and national climate change research: by determining the impact of grazing management on carbon balance of grasslands; by improving techniques for scaling flux measurements to larger scales, and by quantifying how variations in climate affect surface-atmosphere exchange of carbon and water under different management regimes.