Altered precipitation distribution and warming effects in oak savanna: linking plant functional traits and ecosystem processes

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ABSTRACT

This one-year revised plan seeks to understand how contrasting plant functional traits mediate tree-grass interactions in response to climate change drivers of precipitation distribution and warming in oak savanna. We propose to extend plant trait responses to the ecosystem scale by investigating linkages between driver-induced modifications to tree-grass interactions and key ecosystem processes, including coupled carbon and water fluxes. A destructive harvest of the entire experiment will be conducted to examine integrated biomass growth, culminating three years of experimental treatment.

Research will be conducted in southern oak savanna where post oak (*Quercus stellata*), little bluestem (*Schizachyrium scoparium*, a C_4 grass) and an invasive evergreen, eastern redcedar (*Juniperus virginiana*), are the dominant species. The magnitude and direction of tree-grass interactions in this savanna may change with predicted climate changes because the dominant species possess contrasting photosynthetic pathways and leaf habits. Since March 2004, annual rainfall distribution (control, 40% of summer rainfall redistributed to autumn and spring) and warming treatments (ambient, +1.5 °C) have been applied in factorial combination to three species monocultures and two tree-grass combinations. Plots were established in permanent rainout shelters equipped with overhead irrigation and infrared lamps.

The objectives of the proposed research are to: 1) evaluate the independent and combined effects of annual rainfall distribution and warming on the function, growth, and competitive ability of dominant tree and grass species, and 2) investigate the linkages between plant traits and ecosystem processes, including coupled carbon and water fluxes, as mediated by tree-grass interactions and climate change drivers. *The overarching hypothesis is that plant trait responses to seasonal changes in temperature and soil water availability govern tree-grass interactions, which drive ecosystem processes under altered climate change scenarios*.

Tree and grass responses to climate change drivers will be assessed in monocultures and linked to competitive interactions in species mixtures to draw inferences concerning ecosystem processes. The proposed research includes measures of growth and CO_2, H_2O fluxes at the leaf, plant, level as a function of season, water availability, warming, and neighbor species.

*This proposal addresses **focus one** of NICCR program objectives in "evaluating the effects of multiple climate-related factors on terrestrial ecosystems."* The proposed research in a one-year revised plan will provide new information regarding 1) responses of contrasting plant functional types, 2) dynamics of tree-grass interactions, and 3) linkages of these interactions with savanna ecosystem processes in elevated temperature and altered precipitation patterns.