Project Summary

The aim of this proposal is to quantify how predicted increases in hydrologic variability associated with global climate change will interact with key organisms to regulate ecosystem function in intermittent prairie streams. Because these streams are non-equilibrium systems that are regulated by both biotic and abiotic factors, they are ideal for investigating interactive effects of disturbance and biotic controls of ecosystem function. The proposed experiments will combine observations from field experiments in a prairie stream located on Konza Prairie Biological Station (KPBS) with manipulations in replicated experimental streams that closely mimic ecosystem processes of natural streams. In the experimental streams, simulated floods and droughts will be crossed with the presence or absence of two common and locally abundant prairie fishes, a grazing minnow (*Campostoma anomalum*) and a water-column minnow (*Cyprinella lutrensis*). These species represent two major functional groups of stream organisms and are likely to interact with changes in disturbance frequency and intensity in this region. Responses of natural streams to flood and drought will be characterized to allow calibration of results from experimental streams. Stream metabolism (photosynthesis and respiration) and nutrient retention will be the primary response variables because they are central to ecosystem structure and function as well as issues of water quality. These data will help predict how prairie streams will respond to future climate scenarios that include changes in hydrologic variance and species composition. A central hypothesis is that dominant or strongly interacting species will regulate the response of stream ecosystems to climatic change.

Intellectual merit--. Predictions by the International Panel on Climate Change in 2001 suggested that extreme floods and droughts will become more common by the end of the 21st century. These changes in hydrology will greatly influence intermittent streams, which will either expand or contract during these extreme events. Globally, this is of importance because intermittent streams are predominant aquatic habitats that drain about 40% of the continental landmass where precipitation is approximately equal to or less than potential evapotranspiration. Intermittent streams are an important interface with the terrestrial environment and larger perennial waters downstream. Thus, these systems impact water quality and serve as habitat for numerous imperiled species. Understanding dynamics of these understudied streams will assist conservation of these ecologically important habitats. Moreover, because the focus of this research is on disturbance events, these experiments will provide a basic understanding of how biota from different functional groups can influence the resistance and resilience of stream ecosystems.

Broader Impacts--. The proposed research is consistent with the general theme of the Konza Prairie LTER site and will allow broad assessment of the consequences of climate change on an entire prairie ecosystem. Research associated with the experimental stream facility at KPBS also will facilitate public education of prairie stream ecosystems. Each unit is equipped with a viewing port that allows direct observation of stream organisms. The direct observation of the stream biota will help educate the > 4000 visitors to KPBS (general public and K-12 field trips) about the effects of climate change on the functioning of intermittent prairie streams. Recruitment of students from underrepresented groups will be facilitated through cooperation with the Kansas State University Student Undergraduate Research Opportunity Program and the currently funded NSF-REU site activities. Finally, results from this study will be broadly disseminated through peer-reviewed publications, presentation at scientific meetings and posting of relevant data on the LTER network web site.