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Leaf and ecosystem-level gas exchange responses to global change: the Old-field Community Climate and Atmospheric Manipulation (OCCAM) Project

Increasing concentrations of carbon dioxide [CO_2] coupled with increases in global temperatures and changes in precipitation events are likely to impact leaf and ecosystem-level processes, including the exchange of carbon and water. Studies in the past have mainly focused on one or two climatic factors, particularly on the responses of vegetation to CO_2. To improve our understanding of global climate change on biological systems, we investigated the interactive effects of CO_2, temperature, and soil water availability on a constructed old-field ecosystem, including C3, C4, and nitrogen-fixing plant functional types near Oak Ridge, Tennessee. Predawn water potential, and leaf and ecosystem-level gas exchange measurements were performed inside 4-m diameter open-top chambers. We chose a representative species of each functional type to perform predawn water potential measurements, leaf-level and ecosystem-level gas exchange. Preliminary data suggests that CO_2-induced reductions in stomatal conductance may be a contributing factor which ameliorates plant water stress, but reduces leaf-level carbon assimilation. Alternatively, ecosystem assimilation and soil respiration are optimized under increased soil water availability and elevated CO_2. In sum, leaf and ecosystem-level responses to global climate change can ultimately influence community composition in old-field systems.