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ELEVATED ATMOSPHERIC [CO_2] BOOSTS THE PRODUCTIVITY OF MODEL LONGLEAF PINE ECOSYSTEMS WITHOUT ALTERING COMMUNITY STRUCTURE

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ABSTRACT: The current rise in atmospheric [CO_2] is projected to double pre-industrial levels within the next century. Doubling atmospheric [CO_2] has been shown to increase biomass of C_3 plants by an average of 40%. However, individual canopy and understory forest species differ in morphology, physiology, life form and reproductive strategies, and these differences often yield contrasting responses to elevated [CO_2]. Differences in species-level responses make predictions of community-level responses to rising CO_2 difficult. Also, CO_2-induced shifts in competitive advantages between species may alter community composition, structure, and function. To assess the performance of longleaf pine forests to future [CO_2], we constructed a model regenerating longleaf pine community composed of species representing different structural and functional guilds: (1) a C_3 evergreen conifer (*Pinus palustris* Mill.); (2) a C_4 bunch grass (*Aristida stricta* Michx.); (3) a C_3 broadleaf tree (*Quercus margaretta*); (4) a C_3 perennial herbaceous legume (*Crotalaria rotundifolia* Walt. ex Gemel); (5) a C_3 herbaceous perennial (*Asclepias tuberosa* L.). Plants were exposed to either ambient (365 $\mu l\ l^{-1}$) or elevated (720 $\mu l\ l^{-1}$) levels of CO_2 within open top chambers. After two years, CO_2-enriched plots had 109% greater biomass than ambient plots, mainly due to a 117% increase in pine biomass. An extra growth flush was realized by CO_2-fertilized pines in 1999 and 2000. Although pines comprised 4% more of the total biomass in CO_2-enriched plots, overall community structure did not change. Our data suggest that longleaf pine will perform well without altering ecosystem structure in a future higher CO_2 world.