RADIAL GROWTH RESPONSE OF SHORTLEAF PINE (*PINUS ECHINATA*) AND POST OAK (*QUERCUS STELLATA*) TO CLIMATIC VARIABILITY AND MANAGEMENT IN SOUTHEASTERN OKLAHOMA

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EXTENDED ABSTRACT

We investigated the radial growth response of shortleaf pine (*Pinus echinata*) [~24 cm average diameter at breast height (d.b.h.)] and post oak (*Quercus stellata*) (~ 36 cm average d.b.h.) to climatic variation and management using tree cores collected in southeastern Oklahoma near the drier, western limit of their ranges. In 1984, experimental units were created by combinations of pine harvest, hardwood thinning, and fire return intervals of 1, 2, 3, 4 years, and none (late dormant-season prescribed fire). These treatments produced ecosystems ranging from closed-canopy forest (4-year fire return interval or no fire) to savanna (3-year or shorter fire return interval) (Adhikari and others 2021a, 2021b; Feltrin and others 2016). Weather for previous year, current year, and years since fire was used to determine the relationship between radial growth and climate variability (1987–2018) for different management regimes.

Shortleaf pine radial growth increased with growing season precipitation, decreased with average summer temperature maximum, and increased with previous year's average October minimum temperature (Adhikari and others 2021a). Radial growth of shortleaf pine decreased by ~25 percent the first year after prescribed fire for 2- and 3-year fire return intervals. Suppressed shortleaf pine were less responsive to climate variability than intermediate or co-dominant trees. Shortleaf pine growing in savannas appeared less sensitive to annual variation in precipitation. When combined across all treatments, 100 mm decrease in growing season precipitation decreased relative width index (RWI) 5 percent, 1 °C increase in average summer temperature maximum decreased RWI by 7 percent, and a 1 °C increase in the previous year's average October minimum temperature increased RWI by 6 percent.

For post oak, RWI of all treatments was positively correlated to minimum daily temperature the previous September and precipitation late spring/early summer the current-year, and negatively correlated to maximum daily temperatures and drought index late spring/early summer. While absolute diameter growth was greater in stands with lower basal area, RWI of savanna and forest stands responded similarly to variation in weather, and prescribed

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fire did not influence RWI when measured in stands with 4-year fire return intervals. On average, 100 mm reduction in June precipitation decreased RWI by 8 percent, 1 °C increase in previous year September daily minimum temperature increased RWI by 3.5 percent, and 1 °C increase in June maximum daily temperature decreased RWI by 3.7 percent.

Results indicate that hotter, drier spring/summer conditions will reduce growth of shortleaf pine and post oak likely due to reduced soil moisture and increased vapor pressure deficits. However, a warmer autumn may increase growth possibly by extending the length of the previous growing season resulting in more stored carbohydrate for the subsequent year. Savanna systems had more intense fires due to fuel load dominated by dried herbaceous vegetation (average of 1941 and 1381, kW m^{-2} for the 2- and 3-year fire return intervals). This likely reduced shortleaf pine growth due to the scorching of some of the previous year's foliage cohort. In contrast, neither shortleaf pine or post oak were affected by fire at a 4-year return interval because fires were lower intensity. The fuels in the 4-year treatment were dominated by leaf litter and averaged 802 kW m^{-2}. In addition, oak trees did not have leaves at the time of burning. Management to reduce stand density may have increased the resistance of shortleaf pine to drought, but it did not influence the response of post oak trees to drier conditions.

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