

¹ Evidence that growing season length and tree growth are decoupled
² in an urban arboretum

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⁵ Anthropogenic climate change affects many natural systems at the global scale. The most frequently ob-
⁶ served biological impact of climate change—shifts in the timing of recurring life history events (phenology)—is
⁷ likely to have cascading/additional/knock-on effects. For trees, shifted phenology has extended the vege-
⁸ tative growing season, which is widely expected to increase tree growth, with important effects on forest
⁹ carbon sequestration dynamics. Multiple recent studies, however, have failed to find this relationship and
¹⁰ suggested shifts in drought or competition may prevent increased growth. Here, we use two datasets with
¹¹ limited impacts of drought and competition to test for a relationship between longer seasons and tree growth.
¹² These datasets come from a common garden experiment and a citizen science program, both located in an
¹³ urban arboretum. With the common garden project, we monitored leaf phenology for three years across
¹⁴ four species and four provenances (75 individuals), and we collected cross sections spanning seven years
¹⁵ of growth data through tree rings. For the citizen science project, we leveraged nine years of phenology
¹⁶ data across 11 species of mature trees (50 individuals), which we relate to their tree rings. Together, these
¹⁷ data span 14 deciduous tree species of different age classes and over 10 years of growing season length data
¹⁸ (111 to 157 days). We found contrasting evidence that trees grow more during longer seasons. Nine of our
¹⁹ species did not change their growth; two grew less, and three grew more with longer seasons. In contrast
²⁰ to the expectation that fast-growing species would be most responsive to changing conditions, our results
²¹ suggest that the most responsive species were slower-growing, more conservative species. Moreover, with the
²² common garden study, we show little growth differences across the four sites, suggesting provenance effects
²³ may be weak for growth under current conditions. Together, these two complementary datasets indicate
²⁴ that longer growing seasons do not uniformly increase tree growth in an urban arboretum, and that factors
²⁵ other than drought and competition may underlie this observed decoupling. This could substantially affect
²⁶ future forest carbon sequestration dynamics in the context of a rapidly changing climate.