

Effects of Temperature and Relatedness on Plant Phenology

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Introduction

Phenology is the study of seasonal cycles in organisms. This includes events such as leaf and flower budding, fruit ripening, and leaf senescence in plants. Previous research has shown that the timing of phenological events is very important for an ecosystem and that this timing can be affected by environmental conditions (Cleland 2007). Spring events are known to be responsive to temperature, however, it is unknown whether spring and autumn events respond similarly to environmental conditions (Gallinat 2015) or whether closely related species are similar in their timing.

We tested three hypotheses about leaf phenology:

- Warmer spring temperatures will lead to earlier budding.
- Warmer autumn temperatures will lead to later senescence.
- Plants within the same genus will have similar phenology.

Methods

I digitized and analyzed historical phenology data for 33 species collected in Wauseon, Ohio, from 1883 to 1912 (Smith 1915). I scanned the data using an Optical Character Reader (OCR) and sorted observations using a program I wrote in Python. I used linear regression to compare average seasonal temperatures to spring budding and autumn senescence. I compared phenology among four oak species in both spring and autumn events.



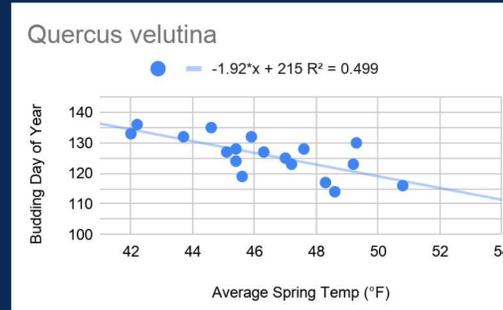
Leaf Budding



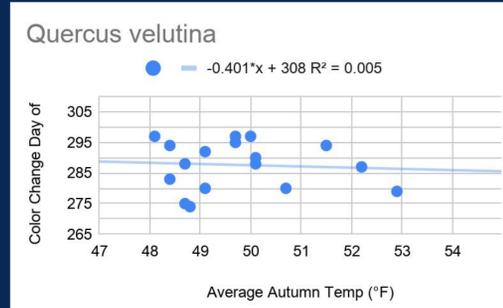
Leaf Senescence

Images from Chicago Botanic Gardens and Ron Exter

Results

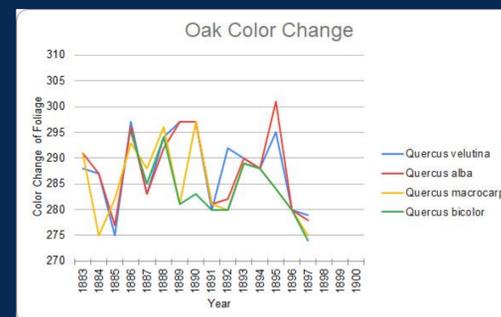
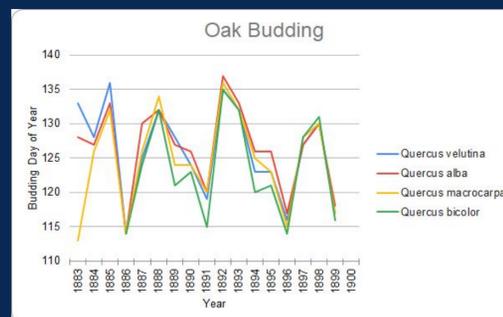


For most species, budding was earlier with warmer spring temperatures.



For most species, autumn senescence had a weak relationship with autumn temperature.

Four oak species within the genus *Quercus* showed similar phenology in both spring and autumn.



Discussion

- We found that across most of the 33 species in the data set, years with warmer spring temperatures tended to have earlier leaf budding. This suggests that temperature is a determining factor in the timing of budding which could lead to a longer growing season under climate change (Beauvieux 2018).
- The direction and strength of correlation between autumn temperatures and leaf senescence varied more than the spring events. Some species showed positive correlations, others showed negative correlations, and most of the relationships were weak. This suggests that average autumn temperatures do not play a major role in the timing of senescence. Other environmental factors such as day length or internal factors such as hormones may have a larger effect on senescence.
- In both spring and autumn events, we found that species in the same genus had similar phenology. This suggests that both spring and autumn phenology could be evolutionarily conserved (Davies 2013).

References

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