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Earlier spring leaf-out caused by climate change is beneficial to tree seedling survival

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Climate change has recently been linked to many negative effects that are detrimental to plant performance around the world and it is expected to become even more problematic in the future. A common trend seen in temperate ecosystems is that patterns of global warming are shifting the phenology of plants (the timing of repeating life events such as flowering and leaf expansion). These shifts have been shown to have cascading effects on everything from pollination to interactions with other plants, and so it is important to investigate the ramifications they could have on plant performance.

Temperate tree seedlings rely on access to understory light in spring to gain the resources they need to survive and grow – research has shown that up to 80% of the resources these plants need are acquired in the early spring before the canopy trees expand their leaves and shade the seedlings. Seedlings that expand their leaves early should therefore gain more access to these resources and increase their growth and survival performance, but this hypothesis was as yet unexplored. In this paper, we investigated how the timing of spring leaf expansion for young tree seedlings affected the amount of carbon they could assimilate (in other words, how efficiently seedlings can perform photosynthesis), and the cascading effects on seedling growth and survival.

We found that seedlings that expand their leaves earlier in spring have higher access to understory light and therefore assimilate more carbon each year than those that leaf out later. Furthermore, we found that seedlings that assimilated more carbon were also more likely to survive and grew more than seedlings that assimilated less carbon. Our results highlight the importance of this dynamic, known as phenological escape, on the performance of temperate tree seedlings, and suggest that climate change could be very harmful if it negatively impacts this period of high carbon assimilation.

The view from the perspective of a seedling in mid-summer under a closed canopy (image credit: Benjamin Lee)