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Red maple leaf plasticity

Research Summary:
The main goal behind my research was to figure out how red maple trees are so successful at regenerating in disturbed forests and at surviving in so many different habitats. Red maple is one of the most abundant and wide-ranging tree species in the northeast, and it will probably continue to spread and succeed in coming years even as climate change harms similar species like sugar maple. Red maple can also survive in an amazingly wide range of conditions – full sun, full shade, wet soil, dry soil, early in forest succession, late in forest succession, etc. This super-generalist ability is key to its regenerative success, but no single physiological trait explains how it can accomplish all of this. Marc Abrams referred to this conundrum as the "Red Maple Paradox" in a literature review of the same name in 1998.

In my research, I hoped to untangle a piece of the paradox by examining red maple's regeneration mechanisms. Red maple regenerates in two very distinct ways: it can grow from seed, or it can sprout vegetatively from a cut stump. These vegetative sprouts form a multi-trunked tree where each stem is clonally identical to the others and to the "parent" tree. This summer, I studied these two mechanisms (seeds and sprouts) to see if they differed in their physiology, morphology, or plasticity over the stages of forest regeneration.

Research Summary, cont.

Yale Myers was the perfect place to conduct this research because it has an amazing chronosequence of shelterwood harvests. Almost every year for the past 26 years a different forest stand has been harvested for timber in a shelterwood cut, leaving plenty of growing space to allow for forest regeneration. I used 10 of these stands ranging in age from 2 years to 24 years, and studied the seed- and sprout-origin red maples in each. In the first few weeks of the summer, I found and numbered every seed-origin and sprout-origin red maple in all ten of the stands and then used a random number generator to pick out 16 trees in each stand to study further. I spent a couple weeks measuring the trees (height, DBH, number of trunks, diameter of the cut stump for the sprout-origin trees, etc.), and then I spent the last month and a half taking leaf samples back to the lab. I carried a pole pruner and a cooler out into the woods with me, clipped upper branches, and took leaves back in individually labeled bags on ice in the cooler. Back at the Yale Myers lab, I studied the leaves with measures of spectral reflectance, stomatal conductance, relative water content, and general morphology. Then I packed the coolers in the trunk of my car and rushed back to New Haven to study the leaves under the digital microscope before they dried out. I looked at the size and density of the stomata, and examined cross-sections of the leaves to measure the thickness of the epidermal layers and mesophyll. And then it was back up to the forest to do it all over again with a different forest stand.