The Carbon Equation

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Climate change is upon us and our government and citizenry seem begrudgingly reluctant to move toward a reduction in greenhouse gas emissions. Vehicle emissions and our car-dependent society haven’t changed much since the 1980s. Energy-efficient building practices are well ahead of vehicles, but nearly three-fourths of our power plants are fossil fuel based. Real improvements are on the horizon for more fuel-efficient vehicles and alternative energy sources, but it will be a long time before significant atmospheric CO$_2$ reductions occur even with new standards and technologies.

On the flip side, energy efficiency is a long-standing practice for many who recognize the importance of reducing fossil fuel abuse. And I count the Garden as a leader in this arena, both historically and in our continuing Conservation Garden practices. Most readers probably know that our Education Center is a shining (Platinum) star in environmental design and energy efficiency, but many might not know that UNC-Chapel Hill has made great strides toward reducing its carbon footprint, to the extent of pledging “carbon neutrality” by 2050 and hiring a greenhouse gas specialist to guide this effort. See climate.unc.edu/ for a comprehensive look at the UNC Climate Action Program.

Becoming carbon neutral doesn’t mean zero emissions, but rather that reduced emissions through renewable energy, alternative transportation, and energy-efficient building practices will be coupled with carbon offsets. And offsets for UNC are principally available through the uptake and sequestration/storage of CO$_2$ by the university’s forested lands!

In an effort to estimate just how much the UNC forested lands contribute to carbon sequestration, a student “Capstone” project was designed to answer this question. Capstone projects are experiential semester-long upper-level undergraduate courses required of all environmental sciences, environmental studies, and environmental health sciences majors, and for sustainability minors.

The “carbon teams” established a total of 80 sample plots in forested areas on the Main Campus (729 acres), the Carolina North Forest (750 acres), and on 743 acres of the Botanical Garden’s 1,000 acres of natural areas. Teams calculated forest carbon storage capacity by estimating tree biomass per plot. Biomass is essentially the total tree bulk (i.e., carbon-based wood) and is determined by measuring tree diameter, height, and spread. Carbon teams then used the i-Tree Eco software program, developed by the U.S. Forest Service, to quantify the carbon storage capacity of all tree species within each plot and then extrapolate to the campus and target forests.

According to UNC Energy Services, campus greenhouse gas emissions (primarily in the form of CO$_2$) were approximately 531,000 metric tons in 2011. From i-Tree the students determined that our campus forests sequestered 6,120 metric tons of this carbon in new woody plant growth (as branches and the most recent growth ring). They also calculated that the total carbon stored in the estimated 748,000 UNC forest trees, based on total biomass, is about 216,000 metric tons. (The complete Capstone project, an interesting read, is available on the Climate Action Program website: climate.unc.edu/GreenhouseGasInventory/EmmissionsBreakdown).

The Capstone report shows that UNC needs to continue greenhouse gas emission reductions and that current UNC forested areas cannot offset emissions at current levels. But let me quickly add that that’s precisely why UNC hired a greenhouse gas specialist, who updates and maintains greenhouse gas emissions data and manages the university climate action plan. (Check out the UNC “Energy Dashboard” itsapps.unc.edu/energy/ that provides real time data on campus-wide energy use, including the Garden’s Education Center!)

The Capstone report also clearly demonstrates the indispensable importance of forested areas and that these need to be protected, properly managed, and increased. It was also nice to see in the report that the largest trees, greatest forest density, and greatest tree species diversity were found on Botanical Garden lands!