Plant carbon gain and water loss strategies as drivers for the maintenance of diversity: A novel approach using leaf carbon and oxygen stable isotopes

How different species assemble into communities and what maintains species diversity over time are central questions in plant ecology. These questions have been explored and at least partially attributed to different biotic interactions, including interspecific competition, pollination, and herbivory. Another potentially critical factor for maintaining diversity in natural communities is how species differentially acquire and use resources through space and time. I will test for resource strategies pertaining to carbon gain and water loss in an old field community in Ithaca, New York. This work will use the carbon isotope composition ($\delta^{13}C$) in combination with the oxygen isotope composition ($\delta^{18}O$) of leaves as an integrated measure of a plant’s carbon gain and water loss strategy. $\delta^{13}C$ of leaves integrates the long-term supply and demand of carbon dioxide, and $\delta^{18}O$ of leaf cellulose integrates the evaporative conditions of the leaf (i.e., the rate of water loss) at the time of cellulose production. Therefore, the combination of these two integrated values describes a plant strategy or efficiency in terms of carbon gain and water loss over the lifetime of the leaf. Variation in $\delta^{13}C$ and $\delta^{18}O$ among species would indicate fundamental differences in carbon and water use strategies that could provide a physiological basis for the maintenance of diversity.