Effect of elevated atmospheric carbon dioxide on tree's water use efficiency and wood economical properties: case study from White Oak in Eastern USA.

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This session presents the latest results from an ongoing study on the effect of elevated atmospheric carbon dioxide on wood quality by studying white oak (*Quercus alba*) in the Eastern United States using stable carbon isotope analysis in tree-rings, that are annually resolved. Author will share 1. Lessons and possible directions in research that will benefit forest managers and 2. Recommendations for undergraduate student's engagement in such large-scale project. Increasing efforts are focused on understanding the effect of elevated atmospheric carbon dioxide (aCO_2) on plants growth and especially forest (trees) dynamics. Most species have shown an increase in growth due to elevated aCO_2, however, that growth is at a cost – wood quality decreases. Wood quality is correlated with timber sales and economical revenues (IBISWORLD, 2015). These qualities can be assessed by examining the annual growth of trees, analyzing its carbon content and provide management strategies to forest managers and timber industry. In this research, we examine white oak (*Quercus alba*) – highly valued timber species in the US for its reliable wood properties – carbon content by reconstructing internal carbon uptake, water use efficiency and wood properties in four sites from the eastern United States. Water use efficiency is quantified by analyzing carbon stable isotope content of the species annual growth. At all four sites, elevated atmospheric carbon dioxide resulted in statistically significant increase in intrinsic carbon dioxide concentration and water use efficiency temporally but little can be said about the increase spatially. In addition, we have also found that variability of annual mean seasonal growth temperature and precipitation played a significant role in annual fluctuations of white oak water use efficiency. In years of drought, wood properties in general, decreased, due to allocation of carbon content to below ground. More conclusive results will be achieved through a longer temporal analysis in comparison with another tree species.

Planned Agenda:

- 10:00 a.m. – 12:00 Research Presentation and Discussion with attendees.
- 12:00 - 13:30 Lunch break
- 13:35 – 18:00 Poster exhibition

Authors' Bios:

Linah Ababneh, Ph.D. Faculty Fellow.Cornell University.

Ababneh's research is concerned with forest ecosystems' adaptation to increases in atmospheric carbon dioxide due to anthropogenic and natural causes. She specializes in carbon stable isotope analysis in organic material (particularly tree rings), using this method to investigate questions related to water use efficiency and carbon sequestering. On an extended time-scale, she investigates forest dynamics and landscape changes by examining the pollen record. At Cornell, Linah teaches Environmental Issues in the Contemporary Middle East, a course focused on providing solutions to environmental pushing issues in Middle East and North Africa, considering the challenges facing the area under current scenarios of global climate change (e.g. drought, pollution). She focuses on engaging undergraduate students in cutting-edge research related to global climate change.

Stefano Sarris. B.Sc. 2016. Summa Cum Laude. Cornell University.

Mr. Sarris has a long-time interest in global climate change research and the role of the international public sector to humanitarian and natural challenges. In pursuit of his goal, he developed an honor thesis (Sarris et al., 2016), analyzing white oak response to elevated atmospheric CO_2 and climate variability using carbon stable isotope analysis in tree-rings. He wrote as a strategic management analysis on the UN-REDD+ Programme through the Cornell Institute of Public Affairs. He served as a Cornell Student Ambassador and concluded an exchange program at the National University of Singapore. Stefano previously worked as visiting researcher at the Copernicus Institute at Utrecht University, the Netherlands – his home country, investigating terrestrial plant responses to alterations in climate, nutrients, and greenhouse gasses. And as an intern at Marstel-Day LLC, environmental consulting, where he developed greenhouse gas and air pollutant calculators. Through dedication, Stefano was recognized as a Cornell Merrill Presidential Scholar, a Coca-Cola Scholar, and a five-time Cornell Endowed Scholar. Stefano is currently a researcher at CityU of Hong Kong, furthering his training in climate dynamics.

Marc Goebel. Ph.D. Research Associate. Cornell University.

Dr. Goebel is an ecologist; his research currently focuses on above- and below-ground forest dynamics in the temperate and boreal zone. He is involved in projects concerning forest stand dynamics of northeast hardwoods in the US, regeneration dynamics of seedling in European beech and Norway spruce under drought and current environmental conditions. He also focuses on species coarse and fine root dynamics and their contribution to soil carbon and nutrients cycling in many different forest types.