DEPARTMENT OF GEOGRAPHY

INDIANA UNIVERSITY

College of Arts and Sciences
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Model-Data Assimilation to Quantify the Effects of Climate Change on Plant Physiological Processes

Abstract: Predictive understanding of terrestrial plant growth and resilience to environmental change is a fundamental problem common to agriculture, ecology and ecosystem science. Understanding the regulation of carbohydrate storage and plant growth under various climate change conditions is one of the most pressing questions in plant ecophysiology to quantify both the future productivity of terrestrial plants and their vulnerability to environmental changes. Because photosynthesis provides the main substrate for plant growth, studies of growth responses to climate change often focus on photosynthetic responses. However, growth is determined by the outcome of many processes. Therefore, my aim is to identify and quantify the responses of other plant carbon processes, including carbohydrate utilization, allocation, and turnover rates, to various environmental stress conditions. I apply data assimilation to data from various manipulative experiments to infer the effects of these manipulations on main carbon balance processes. I also perform attribution analysis to quantify the impact of the response of each individual process to experimental manipulation on overall plant growth. I am able to infer that, in addition to changes in both photosynthetic and respiratory rates, environmental alterations modify the dynamics of non-structural carbohydrate utilization rates, growth respiration, allocation patterns and senescence. The attribution analysis indicates the contribution of all of these process responses to the overall change in biomass observed under various stressed conditions. Applying this approach more broadly would potentially allow us to identify general patterns in these responses that could then be formulated for inclusion into models. Overall, this approach provides important insights into the relationship between carbon uptake and plant growth and could significantly advance our models of vegetation responses to global change.

Friday, January 24, 2020

3:35 p.m. in the

Student Building 005

(Refreshments provided at 3:15 p.m. in Student Bldg. 018)

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