HyARC Seminar (HyARC Seminar#182)

Date: May 27 (Wednesday) 15:00-

Room: The meeting room (#617) of Research Institutes Building.

Speaker:Prof. Ram Oren (Nicholas school of the environment,Duke University)
(https://nicholas.duke.edu/people/faculty/oren)

Title: Responses of forests to changing conditions: Water use and water-use efficiency

Abstract:
A central question posed by researchers using the Free-Air CO2 Enrichment (FACE) experiments was how the cycling of water in forests will be affected as atmospheric CO2 concentration continues to increase. The implications of changing water cycle are numerous. If transpiration is reduced due to stomatal conductance, photosynthesis will not increase in pace with atmospheric CO2 concentration, nutrient uptake may be reduced, further impacting photosynthesis and growth, soil moisture may remain higher, supporting high microbial activity and loss of soil organic matter, and a larger proportion of net radiation will return to the atmosphere as sensible heat associated with warmer surface. On the other hand, downstream ecosystems and users may enjoy a greater supply of water, and drought effects on ecosystem productivity may be partially alleviated. We will first look at pine forests from different parts of the world, assessing the utility of simple variables (vapor pressure deficit, soil moisture and leaf area index) for explaining the variation in transpiration across these forests. We find that transpiration at a reference vapor pressure deficit with no soil moisture limitation is linearly related to leaf area index regardless of other conditions, but as the soil dries, transpiration decreases in a different form comparing sandy and non-sandy soil types. We will then assess, based on results from the Duke FACE and other FACE and chamber studies, whether physiological response to increased CO2 (i.e. stomatal closure, hydraulic changes) is likely to greatly alter the capacity of these same variables to account for variation in transpiration. It seems that reduction in stomatal conductance may not be directly controlled by CO2, but to an indirect response to increasing leaf area, manifested in reduction of hydraulic properties. Generally, it appears that the transpiration response to CO2 (and thus total evapotranspiration and water yield), are most closely related to the response of canopy leaf area, and that increases of ecosystem water use efficiency are mostly related to increased CO2 uptake from enriched atmosphere.

(given in English)