ETH zürich

Institute of Environmental Engineering

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Chair of Hydrology and Water Resources Management

# SEMINAR

*Tuesday, October 4th, 2016, 17:00 h, ETH Hönggerberg HIT K52*

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## ECO-HYDROLOGICAL DRIVERS OF PLANT DYNAMICS – AN OPTIMALITY APPROACH FROM SUB-DAILY TO EVOLUTIONARY SCALES

*Abstract*

The carbon (C) uptake of terrestrial ecosystems is tightly linked to water losses by transpiration, due to the exchange of both water and CO2 through leaf stomata. Water can thus be interpreted as a resource that is consumed to acquire C needed for plant growth. This inherent coupling requires plants to manage available water in such a way as to avoid the occurrence of water stress, while preserving C uptake. Accordingly, it has been hypothesized that plants optimally regulate transpiration to maximize photosynthesis. This optimization problem can be addressed at different time scales – at the sub-daily scale to assess the role of rapidly changing atmospheric conditions; at the dry down scale to predict the effect of soil moisture dynamics; at evolutionary time scales to investigate the effects of hydro-climatic variability on plant fitness. Here we present a hierarchy of optimization models that span sub-daily to evolutionary time scales to yield analytical expressions linking photosynthesis, transpiration, and environmental and climatic drivers. Based on the model results, we define broad plant water use strategies and characterize their success in a changing environment. In some cases, different strategies are found to yield similar long-term plant fitness levels as long as plant hydraulic traits are coordinated, thus explaining why species with widely variable eco-physiological traits may coexist under the same climatic conditions.