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Ecological Acclimation and Hydrologic Response: Problem Complexity and Modeling Challenges

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Elevated CO_2 in the atmosphere leads to a number of acclimatory responses in different vegetation types. These may be characterized as structural such as vegetation height or foliage density, ecophysiological such as reduction in stomatal conductance, and biochemical such as photosynthetic down-regulation. Furthermore, the allocation of assimilated carbon to different vegetation parts such as leaves, roots, stem and seeds is also altered such that empirical allometric relations are no longer valid. The extent and nature of these acclimatory responses vary between C3 and C4 vegetation and across species. These acclimatory responses have significant impact on hydrologic fluxes both pertaining to water and energy with the possibility of large-scale hydrologic influence. Capturing the pathways of acclimatory response to provide accurate ecohydrologic response predictions requires incorporating subtle relationships that are accentuated under elevated CO_2. The talk will discuss the challenges of modeling these as well as applications to soybean, maize and bioenergy crops such as switchgrass and miscanthus.