Date:	January 30 th
Time:	11:00 AM
Location:	Ames 234
Speaker:	Dr. Gabriel Katul Duke University
Title:	"The structure of turbulence within tall vegetation on flat and gentle hilly terrain"

Abstract

In this talk, momentum and CO₂ transport within canopies situated on flat and gentle hilly terrain are discussed. Topography influences almost all aspects of forestatmosphere scalar exchange, yet a limited number of studies considered the role of topography on the structure of turbulence within vegetation and its ultimate effect on key biological processes such as photosynthesis and net ecosystem carbon exchange (NEE). Here, we focus on the interplay between radiative transfer, flow dynamics, and ecophysiological controls on CO₂ sources and sinks within a canopy volume on a cosine hill. In particular, we address how topography alters the forest-atmosphere CO_2 exchange rate when compared to uniform flat terrain. Towards this end, we develop a first order closure model that explicitly accounts for the flow dynamics, radiative transfer, and the nonlinear eco-physiological processes within the canopy volume. We show that at any particular position on the hill, the distribution of NEE departs significantly from their flat terrain counterparts. Close to the hilltop, NEE may be different from its flat terrain counter part by a factor of 3. Furthermore, the horizontally averaged NEE differs from its flat-terrain counterpart by more than 100%. In contrast, the horizontally averaged and vertically integrated photosynthesis only departs from its flat terrain value by a perturbation comparable in magnitude to the mean hill-slope. Implications for flux monitoring on complex topography are also discussed in the context of the relative roles of advective terms and the local CO₂ sources and sinks.