Estimating leaf inclination and G-function from leveled digital camera photography for broadleaf tree and shrub species in Kaisaniemi and Kumpula botanical gardens, Helsinki

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Directional distribution of leaves is one primary parameter for determining the radiation transmission through the canopy. When inverting canopy transmittance measurements for estimating the leaf area index (LAI) or foliage clumping, incorrect assumptions on leaf angles may lead to considerable errors. Often spherical distribution of leaf normals is assumed, i.e. leaf normals are assumed to have no preferred direction in situations where no measurement data are available.

Here we examined if a spherical leaf angle distribution and the resulting isotropic G-function ($G \equiv 0.5$) is indeed a valid assumption for temperate and boreal tree and shrub species. Leaf angle distributions were measured for 62 deciduous broadleaf species in Kaisaniemi and Kumpula botanical gardens in Helsinki in August 2012. The studied species are commonly found in temperate and boreal ecoclimatic regions. The leaf inclination angles were obtained by sampling the complete vertical extent of trees and shrubs using a recently introduced technique based on digital photography [1,2]. It is found a spherical leaf angle distribution is not a valid assumption for both tree and shrub species in temperate and boreal ecoclimatic regions.

Given the influence of leaf angle distribution on inverting clumping, LAI estimates and other paprameters from canopy transmittance measurements or reflectances obtained from remote sensing, it is recommended to use planophile or plagiophile leaf angle distribution as more appropriate for modeling radiation transmission in temperate and boreal ecoclimatic regions when no actual leaf inclination angle measurements are available.

References

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