Spectral libraries for forest reflectance modeling and remote sensing data interpretation

Aarne Hovi[1], Pekka Raitio[1], Petri Forsström[1], Matti Mõttus[2], Miina Rautiainen[1]

[1]Aalto University, [2]VTT

Spectra of scattering elements (leaves, needles, branches) are needed in modeling reflectance and absorption of forest canopies, and in interpretation of remotely sensed data. To date, limited amounts of data on reflectance and transmittance characteristics of various scattering elements have been available for boreal forests. Research in our spectral laboratory at Aalto University has addressed this need by collecting new spectral libraries of vegetation and developing measurement methodologies that would enable faster measurements and hence collection of more extensive spectral libraries. In summer 2016, we measured leaf-level spectra of 25 boreal tree species, including many ecologically and commercially important coniferous and broadleaved species in North America and Eurasia. These data form to date the most extensive spectral library of boreal tree species in the world. Within- and between species differences in spectra were analyzed, revealing important parts in shortwave infrared spectrum where species are separable. As part of method development, we have focused on application of a new double-integrating sphere system for faster spectral measurements. The method has been compared to conventional measurements made with a single-integrating sphere, and to a leaf clip (an instrument commonly used by e.g. plant physiologists). The comparison showed that reflectance measurements of integrating spheres are in good agreement, whereas more research is needed in improving comparability of transmittance measurements as well as reflectance measurements performed with the leaf clip. In the future, we are going to extend the spectral library by acquiring in situ spectra of understory and bark components, of which very limited data are currently available.