The Use of Hyperspectral Remote Sensing in the Assessment of Forest Ecosystem Function

M.E. Martin[1],
S.V. Ollinger[1], M.-L. Smith[2], R.H. Hallett[2], and L. Plourde[1]

[1]Complex Systems Research Center, University of New Hampshire, Durham, NH 03824
[2]USDA Forest Service, Northeastern Research Station, Durham, NH 03824

ABSTRACT

Field studies in forested ecosystems have demonstrated that nitrogen concentration at the leaf- and canopy-scale is strongly related to productivity and nutrient cycling. The *M*apping *A*nalysis of *P*roductivity and *B*io*G*eochemical *C*ycles (MAPBGC) project is a multi-investigator project incorporating extensive field sampling, hyperspectral remote sensing, and ecosystem models to further investigate these relationships and to develop the capability to assess ecosystem status at the regional scale. Previous work demonstrating the capability of NASA's Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has now been extended to the analysis of hyperspectral data from the Earth orbiting EO-1 Hyperion sensor. Both of these instruments measure more than 200 contiguous channels from 0.4 to 2.4 μm with a spectral resolution of 0.1 μm, and a spatial resolution of 17 and 30m, respectively. An AVIRIS image acquisition covering the entire 300,000 ha White Mountain National Forest (WMNF) of Northern New Hampshire has been processed to generate estimates of foliar nitrogen concentration, aboveground net primary productivity, and soil C:N ratio across this region. A parallel effort in this project has been the identification of species across this landscape to better understand patterns in nitrogen cycling as influenced by species composition. Leaf-level sampling of foliar chemistry has shown that tree species in northeastern US forests contain unique combinations of foliar nitrogen and lignin concentrations. Foliar chemical composition derived from hyperspectral data has provided the ability to identify species composition in intensively studied regions of the WMNF. Recent efforts have expanded these applications of hyperspectral data to forests in the Catskill Mountains of New York, the Bago-Maragle Forest in New South Wales, Australia, and to a number of FLUXNET sites throughout the eastern US.