FROM LEAF TO CANOPY: ESTIMATION OF CHLOROPHYLL CONTENT USING REMOTE SENSING TO MONITOR FOREST CONDITIONS

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To develop practical and objective measures of forest condition, the *Bioindicators of Forest Condition Project* has applied a physiological, remote sensing approach. While stress indicators at the leaf-level exist (e.g., chlorophyll fluorescence, and pigment content), developing reliable indicators at the canopy level is a challenge. Hyperspectral sensors, such as the Compact Airborne Spectrographic Imager (CASI), may be useful in remote detection of vegetation stress effects. In this study, an inverse modeling approach demonstrated the capability of the CASI to map chlorophyll content (root mean square errors ranging from 12.6 to 13.0 $\mu g/cm^2$) following different silvicultural practices in a tolerant hardwood (*Acer saccharum* M.) forest. This capability could be readily applicable to operational assessment of forest physiological strain, and in classification of forest condition based on chlorophyll content. The practical significance of developing spectral features related to chlorophyll or other pigments is in identifying whether forests are healthy or stressed (to the point where productivity of the resource may be constrained). A change analysis study was also conducted to evaluate chlorophyll estimation across seasons for a range of sites. Temporal variations in pigment concentrations (e.g. chlorophyll) could provide an objective, early-warning indicator. The implications of these findings and recommendations for a prototype system to monitor forest condition are presented.

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