

Linking Optical Metrics (CCI, & SIF) to Photosynthetic Phenology in Boreal Forests

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Recent studies of chlorophyll and carotenoid pigments demonstrate that pigment ratios provide potent indicators of photosynthetic phenology, and have led to the development of a “Chlorophyll-Carotenoid Index” (CCI) for tracking seasonal photosynthetic activity in evergreens using remote sensing. In boreal evergreen trees, CCI and the chlorophyll/carotenoid ratios vary seasonally, often closely tracking seasonal changes in temperature and photosynthetic activity. Recent work has extended this approach to deciduous and mixed stands, demonstrating a good correlation between seasonally changing pigment levels and photosynthetic activity for both evergreen and deciduous boreal trees. Furthermore, chlorophyll fluorescence follows the pigment and CCI changes, particularly during spring and fall transitions. These results highlight the importance of chlorophyll/carotenoid pigment ratios as indicators of photosynthetic phenology and suggest new opportunities for combined analyses of fluorescence and reflectance in the context of FLUXNET.