Determining optical-physiological relationships via in-situ remote sensing

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The use of remotely sensed optical data has the potential to provide insight into how vegetation may respond to climate change at multiple spatial scales, from the leaf-level to the ecosystem-level. To eventually apply optical sampling methods at the larger spatial scales, it is crucial to first understand the relationships between optical measurements (visible to near-infrared wavelengths) and physiological processes operating at the leaf-level (e.g. photosynthetic efficiency (PSII), net CO2 uptake, leaf area index (LAI), biomass accumulation), where errors associated with sampling from a distance are absent. To thoroughly explore optical-physiological relationships, the appropriate measurements must be made under various environmental conditions and with different plant functional types. For example, Gamon et al. (1999) have shown that the relationships between various optical vegetation indices, such as the photochemical reflectance index (PRI), and plant physiological parameters differ between plant functional types (evergreens vs. annuals vs. deciduous) and change under varying light, water-stress and nutrient-stress conditions.