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FINE STRUCTURE IN THE SPECTRAL REFLECTANCE OF VEGETATION AND SOILS

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The spectral reflective response of plants, soils, and rocks may contain information concentrated in relatively narrow spectral regions defined by the light absorption properties of the constituent atoms and molecules. The hope exists that such information will be of value in remote sensing in discriminating information classes, in identifying growth stages and stress conditions in crops, and in delineating the chemical and physical properties of soils and rocks. Satellite sensors measuring spectral regions possibly as narrow as 0.02 μm, a spectral resolution significantly better than that (0.1 μm) of the Landsat multispectral scanner, appear feasible.

Fine structure in crop spectra has been reported by Collins who identified a shift in the radiance of wheat measured in the far red (near-infrared 0.73 μm) wavelengths, a shift that occurs at the onset of heading. Wiersma grouped spectra from bare soil and vegetation and found a significant amount of non-redundant information in the near-infrared wavelength region in bands 0.02 μm apart.

The paper addresses the key issue raised by Wiersma; if there is information in narrow wavelength bands in reflectance spectra of bare soil and vegetation, is that information attributable to properties of the soil, the vegetation, or both. Four hundred eighty-one spectra representing soils from throughout the United States were analyzed. More than 1000 wheat spectra from four fields measured at four growth stages, several view directions, and several illumination angles were analyzed. The analyses involved the correlation coefficient computed for the spectral reflectance of adjacent wavelengths 0.02 μm apart.

The analysis results show clearly the large water absorption bands at 1.4 and 1.9 μm, prominent in soil and vegetation spectra. The iron oxide absorption band at 0.9 μm is quite pronounced in the analysis results of the soils data. The vegetation analysis results show clearly the transition wavelength region between the visible and the near-infrared, anomalies at 0.53 and 0.57 μm, and minor water absorption bands at 0.95 and 1.15 μm. At three wavelengths, 0.85, 1.05, and 1.25 μm, small anomalies in the results may indicate fine structure in the reflectance data but the finding is tenuous at best.