Remote Sensing of Crop Residue Cover in Central Washington
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Abstract
Crop residue cover has long been important for erosion control in the dryland agriculture region of the Pacific Northwest. Monitoring of residue covers is essential to determine the success of tillage practices implemented over time. The expanse of agricultural land makes on-site monitoring impractical. Imagery collected by satellites may substitute for field measurements. While there are many years of satellite data available for monitoring we need to learn how to interpret the data for sites that cannot be visited. Our approach is to understand the spectra of crop residues and background soils to properly interpret the imagery. The objectives are to define and test spectral differences that allow separation of fresh crop residue (mainly wheat and barley), bare soil, old (weathered) residue, as well as permanent grassland, and to develop spectral indexes that will allow us to map areas that have not been visited.

Spectral data were collected with a spectroradiometer from 1.5 m above each sample cover.

Reflectance curves for standing stubble, flattened stubble, bare soil, and roughened soil compared to sun’s emission spectrum. Note that the soil and crop residue curves are similar at 1650 nm, but very different at 2300 nm. We can exploit these differences by creating an index that corresponds to data collected by the ASTER instrument onboard NASA's Terra satellite. The index is called Normalized Difference Soil Index 48. It models the amount of crop residue in the field.

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NDSI48 = \frac{(ASTER \text{ Band 4} - \text{ASTER Band 8})}{(ASTER \text{ Band 4} + \text{ASTER Band 8})}
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1. The short wave infrared (SWIR) wavelengths have useful information on soil surface covers.
2. Field instruments that collect SWIR data can be used in conjunction with multispectral satellite data.
3. SWIR indexes can be developed to interpret ASTER satellite data and create maps of plant cover over agricultural soil areas.

May 6, 2000
Sept. 27, 2000
May 9, 2001

Near infrared, red, green shown as RGB. Green plants are red, crop residue is tan, soil is blue to gray.

NDSI48 showing green and brown covers in gray scale. Black has no cover, white has complete cover.

Inferences Drawn

May 6, 2000
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Model of the NDSI48 using radiometer data and ground samples for residue cover. The NDSI48 index is highly correlated with the amount of crop residue in the field.