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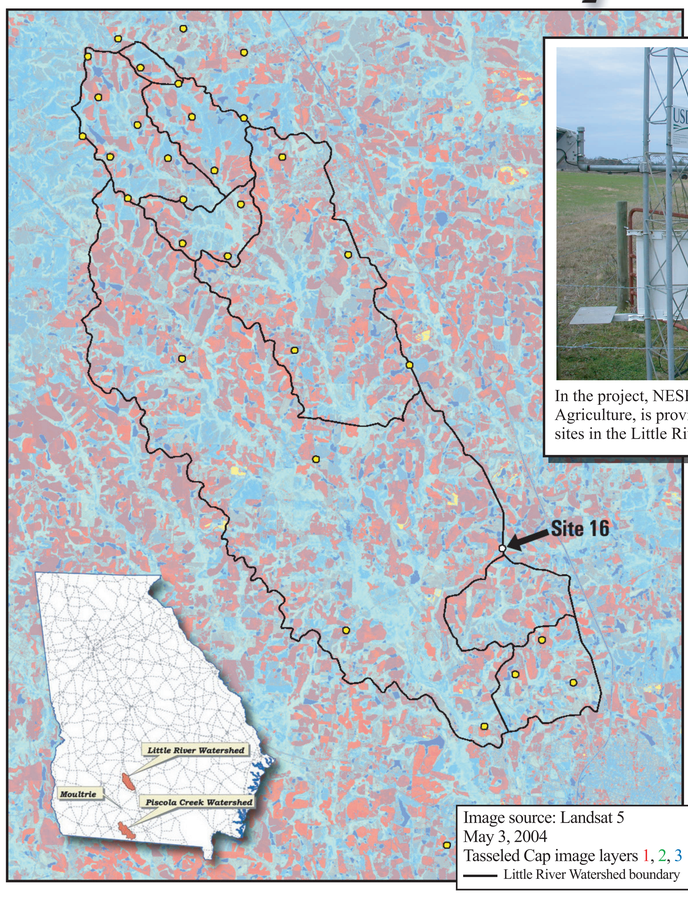
NESPAL USDA ars

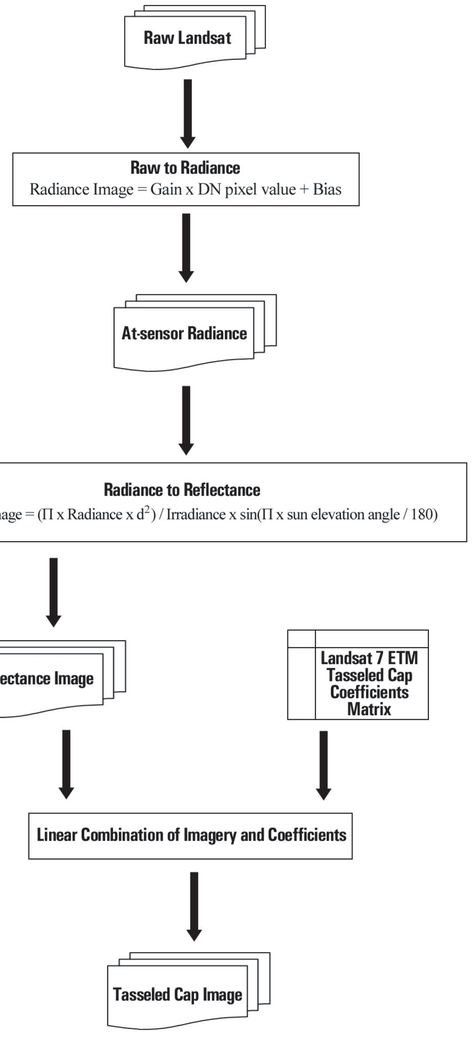
Determining Soil Water Content from Remotely Sensed Data



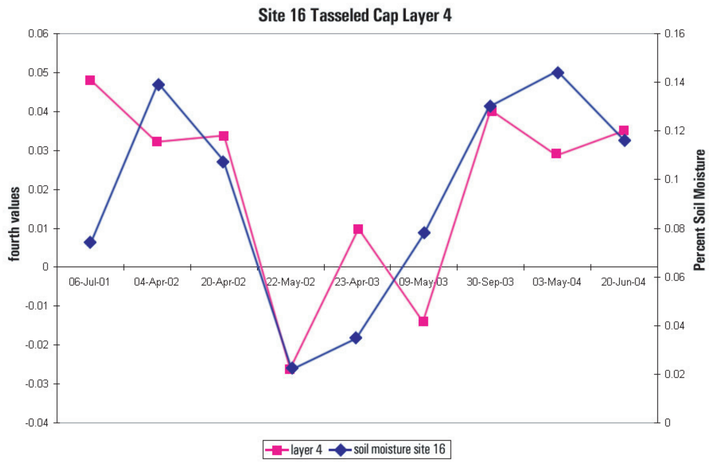
In the project, NESPAL, in cooperation with the U.S. Department of Agriculture, is providing field-collected soil moisture values for sites in the Little River Watershed of southern Georgia.

The USGS is collaborating with the U.S. Department of Agriculture/ Agricultural Research Service (ARS) and the University of Georgia's National Environmentally Sound Production Agriculture Laboratory (NESPAL) in Tifton, Georgia, to develop transformations for medium and high resolution remotely sensed images to generate moisture indicators for soil. The USGS is providing various space borne, remotely sensed multispectral and hyperspectral images covering the field sites in the Little River Watershed, Georgia, collected at particular times, such as before and after rain events and during bare ground conditions. ARS' Southeast Watershed Research Lab developed and deployed the in-situ soil moisture network. In addition, with other cooperators USGS will collect airborne hyperspectral data over sites.

Collectively, we will use the resulting data sets to determine the ability of multispectal and hyperspectral data to measure soil moisture in general and more specifically, to identify the most significant wavelength bands. This research leverages previous work broadly performed by scientists using such remotely sensed images to assist land managers in deriving information about natural resources, hazards, and long-term changes to the landscape. These objectives are in harmony with larger efforts to monitor the changes that occur on the land surface using remote sensing, to study the connections between people and those changes, and to provide individuals and society with information they can use to cope with the consequences of those changes.



The USGS project team is developing and using transformations, such as a tasseled cap transformation for multispectral and hyperspectral images, and other indices of moisture content and attempting to match the field-collected values. Initial processing, illustrated above, requires re-creation of the radiance values at the sensor and exact geometric rectification to allow an exact pixel location match with the location of the ground sample point.



Once this registration is achieved, the transformations can be performed and the match of the moisture values from the image and ground collection can be determined through visual correlation and statistical procedures. Our initial results, testing digital numbers, radiances, reflectances, and tasseled cap transformation values for 9 Landsat images over a 3 year period indicate a reasonable match for layer 4 of the tasseled cap with the ARS ground-collected soil moisture values.

The graph above shows moisture values in blue and tasseled cap layer 4 values in pink. The preliminary visual correlation between these two graphs can be seen. As more sites and imagery are processed the correlation will be better defined and the reason for outlying points will be better explained.

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