Statement of Intent FY04 **4/24/03**

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Program/Project: LRS/GAM

Task: A Method of Determining Soil Water Content from Remotely Sensed Data

Background

The availability of soil moisture affects plant production potential, rainfall runoff volume, and many other parameters that are of interest to agricultural production, forest management, soil conservation, and watershed management and modeling. Current methods of determining soil water are dependent on direct field instrumentation or soil surveys and provide only single values or estimates for long time periods. Remotely sensed images including Landsat Thematic Mapper (TM) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) provide repetitive data coverage of a single area at any time of year. Transformations of the spectral reflectance in these images may be able to provide significant information on soil water content and, if augmented with existing soil and other geographic information, such as terrain elevation and slope, may provide accurate data on soil water content.

Objectives

We propose to examine the ability to generate accurate soil water content from TM and ASTER images in combination with soil, terrain, and other geographic data. The primary objective is to develop a methodology to use remotely sensed data to accurately predict soil moisture.

Hypotheses

Soil water content information is contained in the reflectances present in TM and ASTER datasets.

Spectral and spatial transformations can be used to extract soil moisture from remotely sensed images when combined with appropriate geographic data such as terrain and soil types.

Approach

Our approach is to examine a specific watershed for which accurate measurements of soil water content are being made on a continuous basis and use these data as a standard against which the extraction from remotely sensed data are compared. For a small watershed in South Georgia, the USDA has 30 instrumented stations continuously

collecting soil water content. To these 30 stations, 50 more will be added in the summer of 2003. USDA will collaborate with the USGS to provide accurate soil water content and its distribution among the sampling stations for this watershed for any time. We propose to collect TM and ASTER data for a variety of time periods reflecting differing seasonal conditions that affect vegetation and soil water content. We will then apply standard transformations, such as the Kauth-Thomas or Tassel-Capped transformation, to the TM and ASTER data to generate measures of greenness, brightness, and wetness. We will also develop modifications to these and new transformations as needed to determine soil moisture. The results of these image transformations will be combined with elevation, slope, soil and other geographic data to determine soil water content as a distributed parameter for the watershed. The sample values from USDA will be compared to the transformation results and the extraction procedures optimized.

Personnel:

Michael P. Finn, E. Lynn Usery
David Bosch, USDA (collaborator with in-kind services and data exchange)
GS-11 Cartographer
2 Student Programmers

Duration 2 years