1-1-1980

Delineation of Soil Boundaries Using Image Enhancement and Spectral Signature Classification of Landsat Data

M. L. Imhoff

G. W. Petersen

J. R. Irons

Reprinted from

Symposium on

Machine Processing of

Remotely Sensed Data

and

Soil Information Systems

and

Remote Sensing and Soil Survey

June 3-6, 1980

Proceedings

The Laboratory for Applications of Remote Sensing

Purdue University
West Lafayette
Indiana 47907 USA

IEEE Catalog No.
80CH1533-9 MPRSD

DELINEATION OF SOIL BOUNDARIES USING IMAGE ENHANCEMENT AND SPECTRAL SIGNATURE CLASSIFICATION OF LANDSAT DATA

M. L. IMHOFF, G. W. PETERSEN
Pennsylvania State University

J. R. IRONS
NASA/Goddard Space Flight Center

The concept of using satellite data for soils inventories began with the advent of the first ERTS launch in 1972.

Landsat data can be useful in a field survey, if it satisfies one or both of two requirements: the products must improve the accuracy of the survey and/or it must expedite the survey. These goals can be achieved by creating products that enhance and delineate soil surface features that would not necessarily identify specific soil types but rather provide a spatial boundary that a field scientist could observe and evaluate.

A 250,000 acre tract of semiarid rangeland in east central Utah was selected as the study area. A June 13, 1977 Landsat scene was chosen for analysis. The color composite combined with such ancillary data as geologic maps and topographic quadrangles aided in partitioning the study site into areas of physiographic homogeneity.

A principle components transformation was performed on the data and a uniform contrast stretch was applied to the unaltered spectral bands and the transformed axes. The contrast stretch increased the dynamic tonal range of the data, and created as many as 32 different tonal classes. Various color combinations and a number of density slices were evaluated for their interpretability.

A spectral signature classification of the June scene was developed using both supervised and unsupervised classification algorithms. A canonical analysis was then performed on the thematic maps to improve class separability for image enhancement.

The more promising image products were geometrically corrected, scaled to 1:24,000, and merged with data digitized from a partially completed soils map. The resulting map allowed comparisons between soil lines drawn by a field soil mapper and the classes defined by computer analysis.

Both the enhanced images and the spectral classification maps aided in the delineation of soil boundaries. Enhanced images are inexpensive to generate and, as no subjective class groupings are made, have the added quality of objectivity. The spectral classification maps defined surface characteristics that could be used to help separate soil units. A cost analysis for the individual products and an indepth field evaluation is being completed.