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UTILIZATION OF SPECTRAL DATA DURING THE SOIL SURVEY OF JASPER COUNTY, INDIANA

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

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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.

CORRELATION OF SPECTRAL CLASSES DERIVED FROM LANDSAT MSS DATA TO SOIL SERIES AND SOIL CONDITIONS FOR JASPER COUNTY, INDIANA

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The process of soil survey has been an on-going program in the United States since the early 1930's with aerial photography greatly increasing the speed and accuracy of the survey. Recent innovations in remote sensing techniques have offered the soil scientist a tool to aid in surveying the soils of this country and the world.

Recent work utilizing computer-aided analysis of Landsat MSS data resulted in a spectral soils map of Jasper County, Indiana. This map displayed fifty-two spectral classes which represented the soils found within six distinct parent material areas.

A correlation of the spectral classes with the soils and soil conditions was achieved by inventorying soils on twenty-eight 160-acre randomly chosen sites. The soils data and spectral data were manually overlaid and a dot grid count was made to determine the relative percentages of soils within each spectral class. From these percentages a descriptive legend was developed identifying the dominant soils represented by the spectral class as well as soils that represent significant inclusions.

In addition to developing a legend for each spectral class, various factors involved in the analysis and interpretation of remotely sensed data for soil survey were identified. These factors included: soil-vegetation complexes, crusting of the surface soil, subhorizon exposure, soil surface moisture, organic matter content, texture, and free sand on the surface. Of these, soil-vegetation complexes presented the most widespread problem in interpreting the spectral data. The other factors all altered the spectral response of the soil to some degree, but their influence appeared rather localized.

APPLICATION OF MULTISPECTRAL DATA IN DEVELOPING A DETAILED SOIL SURVEY OF FORD COUNTY, ILLINOIS

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A soil survey program was initiated in Ford County, Illinois in October 1979 with a scheduled completion date of September 1984. The soils of this county are Mollisols (>95%) with dominant drainage classes (>90%) being poorly and somewhat poorly drained. The area has <5% woodland and a minimum of other permanent vegetation. With the initiation of the survey it was decided to use spectral maps as an aid in field mapping.

Spectral maps have been developed by computer-aided digital analysis of Landsat data covering Ford County. The classification maps were developed using a layered classifier technique with the initial decision in the decision tree being related to parent material boundaries that were applied to the data set after field investigations. The parent materials of this area are of Wisconsian age and consist of glacial till and drift, and lacustrine and outwash sediments. Within each of the parent material areas, a systematic sampling procedure was used to develop statistics to apply in the final classification. Maps were developed at a 1:15,840 scale and are presently being used in the field. Preliminary evaluation on the usefulness of these maps in the soil survey program of Ford County will be presented.

DEVELOPMENT OF SPECTRAL MAPS FOR SOIL-VEGETATION MAPPING IN THE BIG DESERT AREA, IDAHO

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Spectral maps were developed using unsupervised digital classification techniques for 1.5 million acres in Idaho to aid the USDA/Soil Conservation Service in preparing a third order soil survey. The area of interest is roughly bounded by 112°45' and 114°00' west and 43°00' and 43°45' north. Mixed alluvium with minor amounts of loess and cinders are the principal soil parent materials of the area which is characterized by rough lava flows, cinder cones, mountains, alluvial fans and valleys of low relief. The soil temperature regime is frigid and the soil moisture regimes vary from aridic to xeric. The native vegetation consists primarily of juniper, sage, grasses and forbs. Rangeland and some irrigated agriculture are the principal land uses in the area.

Geometrically corrected Landsat data collected August 23, 1978 were used for the analyses. To facilitate analysis procedures, the area was divided into two roughly equal parts, eastern and western. A systematic procedure was used to sample and cluster data representing 2% of the area. The resulting cluster classes were merged until the divergences between classes were generally greater than 1500. This resulted in 22 and 19 separable spectral classes for the eastern and western parts, respectively. The final classification was made using a minimum distance to the mean classification algorithm. Maps were provided to the user (USDA/SCS) at a scale of 1:24,000 in units approximating 7½ minute USGS quadrangles. Although detailed evaluation of the usefulness of spectral maps in field mapping of the area has not been completed, some preliminary evaluation of the spectral data based on field reconnaissance and selected order three soil maps of a small portion of the area are presented.

APPLICATION OF LANDSAT DATA ON A LOW ORDER SOIL SURVEY IN SOUTH CENTRAL IDAHO

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Satellite imagery was obtained for approximately 1.2 million acres on the remote Great Rift Zone of the Central Snake River Plain. Using an analytical technique, large-scale land patterns were determined by cluster analysis at a scale of 1:24,000. Field examination of previously selected cluster sample points was done to obtain a correlation of soil surfaces, miscellaneous land types and vegetation species to various reflectance values recorded by the satellite camera. Upon computer analysis of the cluster point sample data, a level of similarity was determined and classes selected for the major land and vegetation patterns. This data is currently being applied to a low order standard soil survey in the area. Its usefulness as a "tool" in generating a general soils map, preliminary mapping, and mapping unit design has helped personnel map this remote area with a higher degree of accuracy and confidence.

GEOLOGIC INTERPRETATION OF REMOTE SENSOR DATA FOR THE BIG DESERT AREA OF IDAHO

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Investigated area covers basalt lava flows in the Big Desert Area and surroundings. Landsat data collected August 23, 1978, covering the area roughly from 112°45' to 114°00' west and 43°00' to 43°45' north was used for the analysis.

To facilitate computer analysis procedures, the area was divided into two equal parts: eastern and western. A systematic procedure was used to sample and cluster data representing 2% of the area. The resulting cluster classes were merged until the divergences between classes were generally greater than 1500. This resulted in 22 and 19 separable spectral classes for the eastern and western parts, respectively. The final classification was made using a minimum distance to the mean classification algorithm.

Visual analyses utilizing aerial photography of the area were performed to characterize different lava types and to compare with the computer classification results of the Landsat data. In addition, structural analyses and interpretation of fissures within the lava flows and fractures of the surrounding area were performed in order to develop a geological model of the structural control of the lava flows of the Big Desert Area.