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PREPARING A SCHEMATIC SOILS MAP OF AN ARID AREA USING LANDSAT IMAGERY

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Between June 1977 and October 1979, a schematic soils map was made of an arid area 2,149,700 square kilometers in size using photointerpretive techniques on 120 Landsat scenes. The smallest mapping unit was about 5000 hectares. The mapping units were named for the soil subgroups that were present. Classification of the soils was based on Soil Taxonomy.

Visual interpretations were made on the images (black and white band 7) after determining the general landscape forms that were present in the scene. Topographic and Geologic maps were used for preliminary identification of similar areas. Delineations of each mapping unit were made on a frosted overlay and temporary symbols were assigned to each unit.

Field trips were conducted to verify and/or correct the names of the mapping units. Only a small portion of the mapping units were checked but they were found to be fairly uniform from one area to the next.

The final product was a series of irregular polygons superimposed on an enhanced Landsat image mosaic. Each unit was coded with a two-digit number and a legend describing each unit was made a part of the map. The map was divided into eight parts to facilitate handling. The final scale of the map was 1:1,000,000.

A great deal of work still has to be done on this map to verify more of the mapping units and quantify their composition. Eventually a general soils map can be made using the Landsat image mosaic as a base map. The present schematic map is useful for planning this developing area at a broad level.

QUANTITATIVE COMPARISON OF TWO SOIL MAPS PRODUCED FROM LANDSAT IMAGES AND AERIAL PHOTOGRAPHS RESPECTIVELY

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A small scale soil survey (1:250,000) was carried out in Southern Spain with the aid of Landsat MSS images and medium scale aerial photographs. One of the objectives of the project was to give a quantitative comparison of the maps resulting from the interpretation of the two types of imagery with a view to testing the reliability of the soil boundaries interpreted from the Landsat imagery, using the API soil map as the standard.

The maps were purposely prepared in the following stages in order to facilitate comparison:

Visual interpretation of black and white prints and color composites of a spring and autumn scene of Landsat imagery without groundtruth documents. These were reinterpreted with the addition of geological and topographic information, followed by a three-week reconnaissance soil survey. The resulting soil map was shelved. This phase was succeeded by air photointerpretation of representative sample areas chosen on the basis of the Landsat soil map, followed by six weeks detail field work in the sample areas. The last stage comprised, photointerpretation and three weeks general soil survey outside the sample areas and the final soil map compilation (API). The map comparison consisted of the following:

(i) Planimetric measurement of the surface areas of equivalent map units followed by linear regression analysis, (Computer).

(ii) Dot-grid count of the overlaid maps. The counts were scored in a rectangular matrix with mapping units of one map against those of the other map.

A high correlation co-efficient was obtained for the areas of the two maps by the regression analysis methods. This was tested statistically and was found to be highly significant.

According to the dot-grid count, more than 70% of most of the 9 landtypes on the Landsat soil map agreed with those on the API soil map. A few however indicated large areas of omission and commission. The agreement of Landunits on both maps were represented graphically by overlapping squares.

The dot-grid method of comparison was more efficient in that it indicated errors of omission and commission.

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SOIL AND LAND-USE DISTRIBUTION OVER A PART OF THE INDO-GANGETIC PLAIN (N. INDIA) DEDUCED FROM THE OPTICAL INTERPRETATION OF LANDSAT-2 MULTISPECTRAL IMAGERY

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The objective of this study was to compare and to correlate ground observations, gathered over the area, with 10 Landsat scenes and to prepare soil and land-use distribution maps of a complex landscape, located between 73°50' and 79°50'E longitude and 26°10' and 31°16'N latitude. The problems of the area are related to soil, land-use and water management planning, erosion, salinity-alkalinity, drought, levelling, high water table, inadequate drainage, etc.

In this study all multispectral color composites, prepared either from positive band 4,5 and 6 or 7, or from negative, contrast enhanced, band 5 and 7, were projected on a blank map (scale: 1/500.000). Areas homogeneous in color or pattern were delineated and identified, based on a generalized interpretation key and by comparison with ground information. The composites yield good pictures of drainage pattern, geomorphic features and major landforms which are helpful to recognize soil boundaries associated with climate and vegetal change, soil parent materials, topographic change and landscape units. A good correlation was found between major landforms discerned on the imagery and major soil units. In developing countries where soil maps at the scale of 1/500.000 or 1/1.000.000 are incomplete or existing maps require revision, synoptic satellite imagery may be beneficial for long term and short term soil and water management projects.

DIGITAL MICRODENSITOMETRIC ANALYSIS OF AERIAL PHOTOGRAPHIC IMAGERY FOR DETAILED SOILS MAPPING

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Much of the agricultural region of the United States is still not mapped with a modern soil survey. A need exists to provide tools which will both expedite the soil survey and place the survey maps in a digital form for implementation in computer data banks. Computer-assisted interpretation of scanned aerial photography may provide an intermediate product which may be used by soil surveyors to more rapidly and accurately delineate boundaries between soil polypedons. Moreover, the resulting raster format map may be easily encoded into data banks for use in a general land records system. Output maps from such a system may be generalized as desired and produced at a scale convenient to the user. The purpose of this study is to investigate means of producing an interim product to be used by field soil surveyors as an additional tool in the mapping of soil individuals.

Color infrared photography at a scale of 1:24,000 was taken by the Department of Natural Resources on 23 April 1979 over a site located approximately 5 kilometers west of Neenah, Wisconsin. The soils of this area are formed in calcareous clayey glacial till and glacial lakebed sediments thickly deposited over dolomite bedrock. The entire area has been blanketed to various depths by aeolian silt. Presettlement vegetation consisted of oak-hickory communities on the uplands and sugar maples and basswood communities transitioning to wetlands on the lowland areas. Relief is generally less than 20 meters, and topography is gently rolling. Most recent glaciation of the area ended approximately 10,000 years ago.

A 96 mm by 115 mm portion from the center of one of the color infrared transparencies was chosen for scanning and analysis. Pixel size chosen was 100 mμ. The transparency and its corresponding film wedge were scanned through narrow band (10 nm) interference filters centered at 450, 550, and 650 nm. The resulting digital data array was corrected to analytical densities by a transformation matrix and to relative log exposures by reference to the film wedge.

A computer-assisted supervised classification was performed on the corrected data using an elliptical table look-up algorithm. Input to the program consisted of statistics from 37 training sets and a user-selected number of standard deviations. Eigenfunctions described the location of the elipses in spectral space, and the standard deviation input governed the size of the elipse for each class. Pixels whose values were included in two or more overlapping classes were classified by means of a maximum likelihood classifier. Additionally, any pixel whose values placed it more than 4 standard deviations from the mean of the best class was designated as unclassified.

Comparison of the resulting color-coded thematic map to the SCS detailed soils map shows general correspondence. However, the classification is much more detailed. Therefore, map evaluation is being conducted by ground study using soil pits and transects of soil auger borings. Preliminary conclusions indicate that the computer classification more accurately delineates soil series boundaries in bare soil areas than does the SCS detailed map.

A similar procedure was conducted on imagery over the same site acquired on 22 September 1978. Preliminary conclusions are that fall as well as spring imagery are useful data sources.

Thus, one may conclude that this technique may provide a useful tool for soil surveyors in regions where fall or spring plowing exposes relatively large areas of bare soil long enough for acquisition of photographic imagery.