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COMPUTER-BASED SOIL DATA MANAGEMENT SYSTEM (COSMAS): ITS FUNCTION AND USE

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The large amount of data accumulated in soil surveys should always be available for research and practical use in agriculture, rural planning, and so on. For this purpose, the data must be managed by a well-organized computer-based system. This paper describes the basic function and organization of the system (COSMAS) now under development by the authors.

The site description and horizon observation of a soil survey are written on a standardized card in numerical and letter codes. Both the location of the observation site and the boundaries of the general soil map in the coordinate system of the base map are recorded by means of a peripheral device, the "tablet." Thus data obtained in the field and in the laboratory are filed by means of the packaged program, SPSS (Statistical Package for the Social Sciences). Four files are now in operation: site description, horizon description, analytical data, and cartographic files, all of which can be cross-referenced with one another. SPSS performs not only statistical analysis, but also such file management as data selection, recoding, and transformation. The processed information can be obtained in a form inherent to SPSS, or in various forms by programs developed by the authors, for example, soil survey report in text, contour maps, soil attribute maps, and transect-attribute diagrams.

As an example of its use, it would be explained here how COSMAS helped us to understand the distribution pattern of different soil materials in a given area.

COMPUTER GENERATED INTERPRETIVE SOIL MAPS FROM SOIL SURVEY DATA

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To facilitate production of interpretive soil maps, computer software has been developed to interface soil boundaries with soil property data. Three Huntington County, Pennsylvania, Soil Survey maps, covering a total of 115 sq. km. at a scale of 1:20,000, were used as a test area. Soil boundaries and mapping unit centroids were digitized using a Tektronix 4954 graphics tablet. Mapping unit symbols were then appended to the centroid data and interfaced with soil property and other data supplied by the Soil Conservation Service.

Software was written for line segment cleaning, polygon processing, and final graphic display. A polygon processing program was written to determine the left and right soil mapping unit for each line segment. This program can also produce area definition files for use with the SYMAP line printer and CALFORM plotter mapping programs.

The complete data set was converted to compressed raster form for display on a color CRT, using a display program written for use with the RAMTEK color display system at the Office for Remote Sensing of Earth Resources at The Pennsylvania State University. Input for this program consists of definition of a selected area and up to 16 color codes. An interpretive map displayed is then output on a color CRT. A color code is selected for each soil type on the basis of soil properties. An automatic color coding scheme is presently being developed.

A SOIL MOISTURE REFLECTANCE MODEL IN VISIBLE AND NEAR IR BANDS

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Reflectance variation of bare soil with different moisture contents was described by a one-dimensional model of soil-water mixture employing the two-stream approximation of the radiative transfer equation. The concept of bulk absorption and scattering coefficients of electromagnetic radiation in the surface layers of moist soil was introduced for derivation of the Kubelka-Munk equations, which had been applied to various reflectance problems. The diffuse reflectivity of moist soil in visible and near-infrared bands could be explicitly expressed in terms of a moisture variable as well as optical characteristics parameters, or vice versa. A method was developed to determine these characteristic parameters from a set of soil reflectivity and moisture data. Hence, surface soil moisture contents could be measured by observing the soil spectral reflectivity. The relationships drawn from the model were supported by the data of bare soil samples in laboratories. The model demonstrated the potential of remote sensing for estimation of soil moisture from readily available remotely-sensed data.

LANDSAT AS A DATA SOURCE IN THE ANALYSIS OF SOIL SALINIZATION ON THE UPPER NILE

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Desertification is caused by two major factors--climatic variation and human modification of the environment. Irrigation in arid regions may play a role in causing desertification by increasing the amount of land that undergoes the process of soil salinization, thereby decreasing the ability of a region to support vegetation.

The purpose of this paper is to report preliminary studies, incorporating Landsat data, on the location, magnitude and collateral effects of salinization. The study area is the Kom Ombo region of the Upper Nile valley about forty miles north of the Aswan High Dam. Landsat data are studied using a microcomputer-based interactive digital analysis system (IMPAC). Classifications of multispectral scanner data are used to delimit major landscape units. By this method of stratification, the alluvial Kom Ombo basin is separated from other major scene components, and the analysis then is concentrated on classification of the alluvial basin. Within the basin, it is possible to identify a series of spectrally unique regions of different vegetation and soil associations. One of these regions is found to be coincident with locations that a soil-hydro-geomorphological model predicts is subject to salinization.

Continued research will expand the study area, will test and soil-hydro-geomorphological model against other regions within the basin, and will use multiple dates of Landsat data to monitor changes in salinized areas.