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# DIGITIZATION AND PROCESSING BY MINICOMPUTER OF LARGE REGIONAL GEOLOGICAL MAPS AND ANCILLARY DATA ON MINERAL RESOURCES

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A systematic procedure is described for the preparation and digitization of geological maps, various geophysical and geomorphological maps, and the distribution pattern of mineral occurrences in a Precambrian terrain area in Northwestern Manitoba, Canada.

The complete task consisting of input preparation, digitization, preprocessing and processing, can be carried out by one person, using a minicomputer equipped with a small graphic tablet digitizer, several display devices, and specially developed Fortran software.

Map patterns of boundaries are transformed into digital images which are mosaics of subimages in registration with each other. From the binary images of boundaries, the pixels occupying the areas of the various map units are labeled and a binary compressed image (one bit per pixel) is extracted for each map unit for additional processing. Logical operations between binary images and neighborhood transformations are computed with the limited degree of parallelism permitted by the word length in the minicomputer (sixteen bits per word). The quantitative characterization of binary geological patterns by parallel processing, is based on concepts of mathematical morphology.

This paper deals with the development of methods for statistical mineral potential estimation from systematically quantified geoscience data. When conditions favourable to mineralization can be identified on geological map patterns, the geometric probabilities associated with these patterns can be combined with the probabilities associated with the distribution of mineral occurrences.

## TEMPORAL ANALYSIS OF LANDSAT DATA FOR LAND USE MAPPING

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Landsat digital data over a period of seven years was used to study the agricultural land use systems of an area in Central Saskatchewan. The study area is situated on the second step of the Great Plains Region about 300 km north of the Canada/U.S. border. It is dominated by Dark Brown and Black Chernozemic Soils on hummocky and undulating morainal materials, although there is a small island of Gray Luvisolic Soils within the area. Local relief ranges from 2 m to 30 m with slope gradients from 2 to 32%.

General land use was mapped by township for the 1976-79 period. The land use classes, were derived by combining the most obvious spectral classes, water and bare soil, from each of the four years. Each year's data was geometrically corrected to the UTM projection to facilitate the mapping procedures. The resultant maps were verified with aerial photography of selected townships and then used to update the land use maps of the area.

Multitemporal analysis of individual farm holdings provided approximate areas of agricultural land use system components and crop rotation lengths. The dominant agricultural system in use in the region was one or two years of wheat or barley followed by one year of summerfallow. The two year rotation of fallow and grain shows a decline from 45% between 1973 and 1975 to 20% between 1976 and 1978. There is a consistent increase in the cultivation of rapeseed from 1973 to 1979, and continuous cropping is rarely practiced in the region.

## REMOTE SENSING AND LAND USE PLANNING

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Concern for the availability of agricultural land has prompted many states, counties and local communities to initiate programs aimed at stopping the conversion of agricultural land to other uses. Sound land use planning efforts and management programs rely upon adequate information.

In responding to the needs of timely and detailed information on changes in Land use, the U.S. Department of Agriculture and the U.S. Geological Survey have been engaged in monitoring and inventory of Land use for selected areas. In this paper, a methodological framework for monitoring changes in land use that is timely, relatively inexpensive, and appropriate for widely varying needs at state and regional levels is provided. Changes in land use pattern in one of the fastest growing areas in America have been measured through the use of remote sensing techniques and statistical theories. Policy implications of changes in terms of proper land use planning of the efficient uses of other natural resources are also presented.

LAND USE POTENTIAL SURVEY OF THE  
SEGUENEGA AREA OF UPPER VOLTA,  
USING LANDSAT DATA

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The Seguenega area is a densely populated area of approximately 1500 km<sup>2</sup> in the southeastern part of the Yatenga region in northwestern Upper Volta. Agriculture and livestock herding are the principal occupations of the inhabitants of this semi-arid part of the sub-Sahel.

Africare has contracted with the Agency for International Development (AID) to institute an Integrated Rural Development Project in Seguenega in cooperation with the Organisme Regional de Developpement (ORD) of Upper Volta. As a part of this effort Africare requested that the Laboratory for Applications of Remote Sensing at Purdue University assist them in producing a base map to use in developing land use potentials in the Seguenega region.

Landsat-2 MSS data collected on 31 March 1976 were utilized for this study. The MSS data were geometrically corrected (rotated, deskewed and rescaled to approximately 1:20,000). Nineteen separable classes were identified in the Seguenega area using a nonsupervised clustering program which sampled two percent of the area. The entire area was then classified using a LARSYS minimum distance classification algorithm.

Spectral maps developed from the classification results were used in making ground observations in the Seguenega area. Because of the lack of readily identifiable features such as roads, rivers and lakes and other ancillary data, such as detailed topographic maps or air photos, it was difficult to locate good ground control points. However, using the spatial characteristics of the Landsat classification maps, it was possible to subjectively relate groupings of the nineteen spectral classes to six groups representing soil, water and vegetation cover types. The final product was a 1:20,000 map representing six land cover

classes from which interpretations of land use potential can be made.