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ORSER-SSEL Technical Report 24-74

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LAND USE MAPPING IN ERIE COUNTY, PENNSYLVANIA - A PILOT STUDY

G. A. May

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INTERDISCIPLINARY APPLICATION AND INTERPRETATION OF ERTS DATA
WITHIN THE SUSQUEHANNA RIVER BASIN

Resource Inventory, Land Use, and Pollution

Office for Remote Sensing of Earth Resources (ORSER)
Space Science and Engineering Laboratory (SSEL)
Room 219 Electrical Engineering West
The Pennsylvania State University
University Park, Pennsylvania 16802

Principal Investigators:

Dr. George J. McMurtry
Dr. Gary W. Petersen

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LAND USE MAPPING IN ERIE COUNTY, PENNSYLVANIA - A PILOT STUDY

George A. May

In response to a request from Environmental Protection Agency (EPA) a pilot study was undertaken to map land use in the Great Lakes Basin area utilizing ERTS-1 data. The desired objectives included the mapping of residential areas, cropland, forests, recreational areas, and drainage patterns. The ultimate goal was to map the land along the Great Lakes by watershed areas and determine the percentage of each of the above land uses within each watershed.

The main objective of the pilot study was to determine if it was possible to map land use along a portion of Lake Erie, in Erie County, Pennsylvania. The ERTS-1 data utilized was from the August 21, 1972 overpass, the only cloud-free data of Erie County available at the time (scene 1029-15352). A subset was made of an area extending from Erie to the town of North East and approximately 35 miles inland. A portion of Lake Erie was also included. The data appeared to be of excellent quality.

A mosaic of Erie County was made from the Erie County soil survey report¹. This mosaic, along with direct knowledge of the Erie area, was used as ground truth in this study. The scale of the mosaic was 1:20,000, which is close to that of the computer printouts. USGS 7.5 minute quadrangle maps of the Erie area were also available for reference.

The NMAP program², yielding a brightness map which could be compared with the data of the mosaic, was applied to the subset data. After manipulating the classes and their limits on more than fifteen runs, many identifiable features could be mapped. The most striking were the streams in the area. These streams are small in nature but can easily be identified from near their starting point to where they enter the lake. It appears that the trees along their length may be a significant factor in mapping these streams. Most of the area immediately away from the streams is in agricultural use; therefore, the spectral response of the water, and trees along this water, differs substantially from that of the agricultural land. Field patterns could also be seen, permitting separation of forested from cultivated areas.

Railroad lines can easily be discerned from the brightness map. A line paralleling the lake and consisting of four parallel sets of track was easily identified. Features such as Presque Isle State Park, docks along the shoreline, and the city of Erie, were easily seen.

¹USDA, Soil Conservation Service (1960) Soil Survey, Erie County, Pennsylvania, Series 1957, No. 9.

²See ORSER-SSEL Technical Report 10-73, 16-74, or 10-75 for program descriptions.

ABSTRACT

ORSER-SSEL Technical Report 24-74

LAND USE MAPPING IN ERIE COUNTY, PENNSYLVANIA - A PILOT STUDY

G. A. May

A pilot study was conducted for the Environmental Protection Agency to determine the feasibility of mapping land use in the Great Lakes Basin area utilizing ERTS-1 data.

A portion of the Lake Erie shoreline in Erie County, Pa. was mapped using data from ERTS-1 scene 1029-15352 and the ORSER computer programs NMAP, UMAP, DCLUS, and STATS. Ground truth included a soils map mosaic constructed from the Erie County Soil Survey Report, at a scale of 1:20,000; USGS 7.5 minute quadrangle maps; and field knowledge of the area.

The following results indicated that it is feasible to map the Great Lakes Basin area using ERTS-1 data:

Small streams were clearly defined by the presence of trees along their length in predominantly agricultural country.

Field patterns were easily differentiated from forested areas; dairy and beef farms were differentiated from other farmlands, but no attempt was made to identify crops.

Large railroad lines and major highway systems were identified.

The city of Erie and several smaller towns were identified, as well as residential areas between these towns, and docks along the shoreline in Erie.

Marshes, forests, and beaches within Presque Isle State Park were correctly identified, using the DCLUS program.

Bay water was differentiated from lake water, with a small amount of misclassification.

A uniformity map of the data was also obtained, using the UMAP program. The uniformity limit was continually decreased, in a series of runs, to obtain high uniformity in the areas of interest. Uniform training areas were selected for cities, residential areas, forests, and agricultural land (both along the lake and inland). These training areas were chosen by correlation of the brightness map, the uniformity map, and the Erie County mosaic. Some training areas in Presque Isle State Park were selected using the cluster analysis program (DCLUS). Signatures from all these areas were derived from the STATS program.

A classification map, using the DCLASS program, was produced using a critical angle of 5.0 for all signatures, yielding good results in the mapping of land use. Several residential areas were mapped, including the city of Erie, Wesleyville, and the town of North East. Only two signatures were necessary to map the residential areas along Route 20 connecting Erie and Wesleyville.

The bay water between Presque Isle and Erie was distinguished from Lake Erie, although a small amount of misclassification did occur. There were no lakes or ponds of any appreciable size within the study area. Marsh areas, forest areas, and the beaches of Presque Isle State Park were correctly classified. Land in dairy and beef farming was mapped, but this study made no attempt to classify agricultural land into different crops.

A pleasant surprise was the mapping out of road systems. Both I-90 and I-79 were delineated. Route 19 was also mapped and its intersection with I-90 was discerned.

This study was undertaken to determine the potential of ERTS-1 data from mapping land use in the Great Lakes Basin. All areas of interest stated in the objective of the study could be mapped. No attempt was made to map small features, such as field boundaries, within the agricultural land. Through the use of the DCLUS program, many other objects or areas of interest could have been delineated. The DCLUS program was used only on Presque Isle State Park, enabling detailed mapping of land in the park.