DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FOLIO OF LAND USE IN THE WASHINGTON, D. C. URBAN AREA
MAP I–858–E

290 km E UTM Grid Zone 18 350 km E
4340 km N
4280 km N
77°20' W 77°10' W 77°00' W 76°50' W
39°10' N 39°00' N 38°50' N 38°40' N

## LAND COVER MAP FROM LANDSAT, 1973, WITH PLACE NAMES

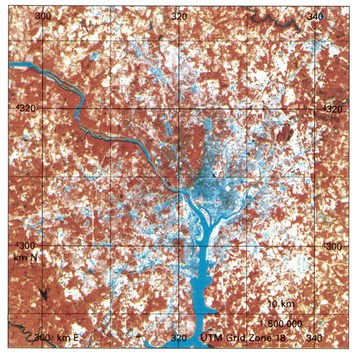
By Leonard Gaydos and James R. Wray

The Washington urban area, shown below, occupies the central part of a Landsat image of Upper Chesapeake Bay; (frame E–1080–15192, October 11, 1972)(U.S. Geological Survey, 1976). The image is reconstructed from three of four multispectral data sets in digital form on computer-compatible tapes using enhancement techniques developed by International Business Machines (IBM) Corporation.[1]

The accompanying map is an interpretation of land cover derived by computer-assisted analysis from the same tapes, combined with those for a later scene (E–1260–15201, April 9, 1973). The establishment of land cover classes required six days of analyst time using LARSYS III computer software developed at Purdue University's Laboratory for Applications of Remote Sensing (LARS). Techniques for over-laying data for two scenes and fitting their geometry to the base map were developed by LARS and adapted through EDITOR software by the University of Illinois' Center for Advanced Computation (CAC). Assignment of over 775,000 data cells (pixels) to land cover classes was done in 8 minutes on the ILLIAC-IV parallel-processing computer at NASA Ames Research Center.

Four separation negatives for printing the land cover map in color were prepared directly from the classification tape by Mead Technology, Inc. For each pixel, a laser-exposing technique provides a random dot matrix geometrically repeatable for every other pixel. USGS personnel enlarged the negatives to publication-scale, and also specified original negative densities that would produce color symbols predictably legible under map overprint using only four process ink colors on the Survey's printing press.

[1]The use of brand names in this report is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.




### EXPLANATION , LAND COVER CLASSES
(and number of spectral classes)

| | | Table Code | Map Symbol |
|---|---|---|---|
| Built-Up Area | Commercial, industrial, and services (3) —includes bare rock | LC | |
| | Parking, and paved surfaces (2) —includes special runway | PV | |
| | Residential, older (1) —with mature landscaping | RM | |
| | Residential, newer (5) —with less mature landscaping | RS | |
| Transition | Disturbed land (3), cover in transition —includes extractive industry | TR | |
| Open Space | Improved open space (1) —includes golf course, cemetery, grass | OP | |
| | Agriculture (3) | LA | |
| | Unimproved open space (3) —includes forest land and brush land | OU | |
| | Clouds (1) | CL | |
| | Cloud shadows (1) —includes some wetland | SH | |
| | Water (3) | OW | |

### EXPLANATION FOR LAND COVER (continued)

Twenty-six spectral classes developed statistically have been combined into 11 land-cover classes. Except for small amounts of cloud and cloud shadows, these roughly correspond to the land-use classes for 1970 appearing on folio map I–858–A. The 1970 classification represents one prototype of some Level I and Level II classes adopted for nationwide land-use and land-cover inventory, and subsequently described by Anderson and others, 1976. The land cover symbols (colors) on the 1973 map have been chosen to facilitate visual comparison between the two maps. While there is general agreement, any careful comparison must make three allowances: (1) Difference in time, 1970 *vs* 1973; (2) difference in minimum mapping unit size, 4 hectares (9.88 acres) in 1970 *vs* 0.464 ha (1.14 acres) in 1973; and (3) difference in classes resulting from differences in data sources and methods of interpretation. The 1970 classification was derived by manual interpretation of aerial photographs. The 1973 classification is derived by machine-assisted interpretation of multispectral data from Landsat satellite; it mainly represents differences in surface cover. (For example, compare Andrews Air Force on the two maps, map area 4295 km N, 335 km E.)

The map explanation shows the number of spectral classes comprising each land cover class. Each spectral class is retrievable on the classification tape, which is also available. Working with the data in tape form permits many other combinations to be mapped and tabulated.

The table code shown in the legend facilitates comparison between the land cover map and sample area tabulations. To demonstrate just one of many possibilities, area summaries for 5×5 km UTM grid cells (2500 hectares) are printed on the back of the map. When the right (east) quarter-panel is folded over the map face, area summaries for the west half of the area can be compared directly with the map. Likewise, the back of the left quarter-panel contains summaries for the east half of the area.


Anderson, J. R., Hardy, E. E., Roach, J. T., and Witmer, R. E., 1976, A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964.

U.S. Geological Survey, 1976, Satellite image map, NASA Landsat imagery, "Upper Chesapeake Bay," N3849 W07649 (1972), 1:500,000, second experimental edition.


### EXPLANATION, CULTURAL FEATURES

- Limited access road
- Other road
- Route number: Interstate (I) / U.S. / State
- Railroad
- Landmark feature
- State boundary
- County boundary
- Reservation boundary, or property line

### CENSUS CITIES EXPERIMENT IN CHANGE DETECTION

This map is one prototype product resulting from experiments in land-use and land-cover inventory and change detection using data gathered by remote sensors aboard aircraft and Earth-orbiting satellites. Remotely sensed data and census data have been assembled for a sample of urban test sites, including Washington, D. C. These efforts were begun as parts of the Department of the Interior's Earth Resources Observations System (EROS) Program and the National Aeronautics and Space Administration's Earth Observations Program. They continue as part of a more inclusive USGS commitment for the inventory and analysis of land information.

The coordinate grids and base map with place names are the same as those compiled on the orthophoto base used in folio maps I–858–A through –D. Latitude and longitude in the geographic coordinate system are indexed by cross ticks at a 5-minute interval and are based on a conformal projection. The Universal Transverse Mercator (UTM) coordinate system is shown at a 5-km interval. Row and column position of Landsat data cells (pixels) are fitted to a network of 50 control points located in both coordinate systems. Either system may be used to relate map features to those shown on topographic maps published by the USGS. For the experiment, the UTM grid and metric system form the basis for sheet lines, sheet numbers, location control for computer mapping, area measurement, tabulation of data by statistical area centroid, and compilation of map gazetteer.

MAP AREA DESIGNATION (280–290/60)

The numbers in the map area designation (280–290/60) define the location and extent of the map coverage. The first three digits indicate the location of the southwest corner of the sheet in kilometers North of the Equator: the prefix 4—4,000 km or 4,000,000 m—is omitted. The next three digits are the sheet corner's location in kilometers East. These coordinates are the lowest Northings and Eastings on the sheet. The map covers a square extending 80 km northward and eastward, hence the last two digits in the area designation.

SCALE 1:100 000

1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
1 0 1 2 3 4 5 MILES

one sq. mile = 640 acres = 259 hectares
one sq. km = 100 hectares = 247 acres
one mile / one km

Land cover cells are presented in 787 rows and 985 columns, or 775,195 data cells (pixels). Each pixel represents approximately 76 m by 61 m on the ground, (0.464 hectares or 1.14 acres). 1 cm. represents 1.0 km., 0.625 mi. 1 in. represents 2.54 km., 1.58 mi.

GN
MN TN
GN: 1°18'W 23 mils
MN: 8°00'W 142 mils
DECLINATION DIAGRAM

# LAND COVER MAP FROM LANDSAT, 1973, WITH PLACE NAMES

## WASHINGTON URBAN AREA, D. C., MD., and VA.

U.S. Geological Survey, 1978


INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1978—L7362

For sale by U.S. Geological Survey, Reston, VA 22092.
The machine-assisted land cover data for Washington are available on computer compatible tape 'WED029' from the National Technical Information Service, Springfield, VA 22161. Request computer tape number PB–264650.
Original Landsat data in image and tape formats can be ordered from EROS Data Center, Sioux Falls, SD 57198.