NATIONAL LAND USE AND LAND COVER INVENTORY

by

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ABSTRACT

At the request of the U.S. Environmental Protection Agency, Environmental Sciences Research Laboratory (ESRL) - Research Triangle Park (RTP), North Carolina, The Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, conducted a land use inventory of the United States and border Canada east of W105° longitude. The land use data was provided as an input to a meteorological model being developed by ESRL-RTP. Land use data was assigned, on the basis of 20 kilometer grid cells covering the study area, as a percentage of each of ten land use and land cover categories within each cell. A computer record of the latitude and longitude of the center point of each cell and its associated land use provided the data product. Land use and land cover were derived from the U.S. Geological Survey Land Use and Land Cover map series, from Landsat regional mosaic images, and from single scene Landsat spot coverage.
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INTRODUCTION

The Environmental Monitoring Systems Laboratory in Las Vegas, Nevada conducted a land use inventory of the United States and border Canada east of W105° longitude, at the request of the U.S. Environmental Protection Agency, Environmental Sciences Research Laboratory (ESRL) - Research Triangle Park (RTP), North Carolina. The land use data was provided as an input to an atmospheric and meteorological model being developed by ESRL-RTP. Land use data was assigned, on the basis of 20 kilometer grid cells covering the study area, as a percentage of each of ten land use and land cover categories within each cell. A computer record of the latitude and longitude of the center point of each cell and its associated land use provided the data product. Land use and land cover data were derived from the U.S. Geological Survey (USGS), Land Use and Land Cover (LULC) map series, from Landsat regional mosaic images, and from single scene Landsat spot coverage. This report provides a synopsis of the methodology, data analysis, and data products arising from the project.
METHODOLOGY

BASIS

The basis for the land use and land cover inventory was the National Topographic Map, 1:250,000 scale series, drawn on a transverse Mercator projection and covering 1° of latitude by 2° of longitude. The use of these maps as the basis of the inventory provided two advantages. First, they coincided with the scale of available USGS LULC maps. LULC maps provide a consistent level of detail and standardization of land cover categories. Second, the 1:250,000 scale topographic map series loaded itself well to the specified 20 kilometer cell inventory size.

DATA ACQUISITION

Two sets of Landsat black and white (Bands 5 and 7) mosaic images at a scale of 1:1,000,000 covering the inventory area were obtained from the Cartographic Division of the Soil Conservation Service, U.S. Department of Agriculture. Band 5 imagery (0.6-0.7 micrometers) was acquired during periods July 23 through October 31, 1972 and January 1 through March 15, 1973. Band 7 imagery (0.8-1.1 micrometers) was acquired during the same periods. Next, all available LULC map coverage east of W105° longitude was obtained from the National Cartographic Information Center. Landsat spot coverages in the form of single scene, color composite prints (scale 1:1,000,000) was obtained over major metropolitan areas, where LULC map coverage was not available, and where the quality of black and white Landsat mosaics was not sufficient to interpret
land cover patterns. This coverage was obtained from the EROS Data Center. Finally, black and white, single scene Landsat prints (scale 1:250,000) of the U.S. - Canada boundary region were also obtained from EROS.

GRID CELL CONSTRUCTION

Data product requirements specified that land cover be classified on the basis of 20 kilometer grid cells. To construct the specified grid, a master grid template was created for each 1° of latitude. Each template was divided in 1/4° longitude and 1/6° latitude increments. Since the 1:250,000 scale series maps cover a standard 1° of latitude and 2° of longitude, this division resulted in a 6 by 8 grid net with a cell of exactly 20km on a side at 25.85°N latitude.

However, polar convergence of longitude lines on the Transverse Mercator projection employed by the 1:250,000 scale maps results in a progressively narrower cell size (east-west dimension) from south to north. Therefore, using a separate 6 by 8 grid net for each 1° of latitude resulted in a variable cell size along a constant line of longitude. The east-west cell dimensions varied from 20.14km at the latitude of Key West to 14.28km at 50°N latitude.

While cell size varied from the specified 20km square throughout the study area, problems such as grid cell continuity and fit from map sheet to map sheet along the longitudinal dimension was avoided.
REVISIONS TO LAND-USE AND LAND COVER INVENTORY

Revised Land-Use Categories

1. Urban Land
2. Agricultural Land
3. Rangeland
4. Deciduous Forest
5. Coniferous Forest
6. Mixed Forest (including Forested Wetland)
7. Water
8. Barren Land
9. Non- Forested Wet-Land
10. Mixed Agricultural Land and Rangeland
11. Rocky Open Places Occupied by low shrubs and lichens

Revised Coverage

The inventory now covers the 48 contiguous States and some of southern Canada.
DATA ANALYSIS

LAND USE AND LAND COVER CLASSIFICATION

A land use and land cover classification system consisting of 10 fields or categories was available for each grid cell. The following categories were applied as a percentage of total land use and land cover in each cell.

1. Urban Land
2. Agricultural Land
3. Rangeland
4. Deciduous Forest Land
5. Coniferous Forest Land
6. Mixed Forest Land (including Forested Wetland)
7. Water
8. Land Falling Outside the Study Area
9. Non-Forested Wetland
10. Mixed Agricultural Land and Rangeland

LAND USE INVENTORY, REGIONS

The land use inventorying process was divided into six regions comprising the entire study area eastward from 105°W longitude, including border Canada 1° north of the U.S. border. Map sheets covering coastal areas defined the inventory limit on the east and south, except those covering the U.S. - Mexican border, where the border itself provided the inventory limit. The six inventory regions along with the number of map sheets covering each region in parentheses (), and their geographical limits are as follows:

1. Northeast (67), lat. 38°-48°N, long. 66°-84°W 9 (includes Canada boundary coverage)
2. Southeast (53), lat. 24°-38°N, long. 74°-88°W
3. Northcentral (83), lat. 38°-50°N, long. 84°-98°W
   (includes Canada boundary coverage)
4. Southcentral (49), lat. 24°-38°N, long. 88°-98°W
5. Northwest (48), lat. 38°-50°N, long. 98°-105°W
   (includes Canada boundary coverage)
6. Southwest (40), lat. 24°-38°N, long. 98°-105°W.

ANALYSIS PROCEDURES

In the case of inventory areas where LULC coverage was available, the following analysis procedure was employed. The 1:250,000 scale topographic map and its corresponding LULC map were registered and attached to a light table and overlain with the 6 by 8 grid cell template corresponding to the latitude of the maps. The percentage of each of the 10 land use categories was then visually assessed.

Where LULC coverage was not available, image detail from Landsat mosaics or spot coverage was visually matched to ground coverage on the map sheet specified by the appropriate cell. Again, land cover percentages were then visually assessed, and assigned to the cell.

Data was recorded at a computer terminal adjacent to the light table. A number of data input computer directives were available, depending on the nature of land use and land cover patterns in any specific area. Data could be collected and input to a disk file by the following parameters:

1. **Single 'Pixel' Data Collection** - specify the latitude/longitude coordinates of the southeast corner of an individual grid cell, enter percentages.
2. **Collect Data for Standard Map** - specify the latitude/longitude coordinates of the southeast corner of a
map sheet; computer will display, one at a time, the coordinates of all 48 cells on the map sheet in normal raster-scan order. As the coordinates of each cell are displayed, land use percentages are assessed and entered on the terminal, the next cell coordinates are displayed in sequence. The process is then repeated until the map sheet is totally inventoried.

3. 'Paint' Rectangular Region - specify the latitude/longitude coordinates of the southeast corner of the southeast pixel in the rectangular region, then specify the coordinates for the southeast corner of the north-west pixel in the region. Land use percentages assigned for each 10 categories will be assigned to all cells in that rectangular region.
C *** CODE TO READ THE LAND USE FILE.
C *** FILE HAS 23712 LINES.
C DIMENSION ICAT(10)
READ(10,200)LADEG,LAFRAC,LODEG,LOFRAC,ICAT
200 FORMAT(4I4,10I6)
C WHERE:
C ***LADEG IS THE WHOLE DEGREE OF LATITUDE
C AND LAFRAC THE FRACTION IN SIXTHS OF A DEGREE
C ***LODEC IS THE WHOLE DEGREE OF LONGITUDE
C AND LOFRAC IS THE FRACTION IN SIXTHS OF A DEGREE
C ***ICAT IS AN ARRAY FOR THE TEN CATEGORIES OF LAND USE.
C **** FURTHER CODE
END
```
3FTNCS IX
FNT 10 R
1.  DIMENSION IFREQ(I),N:COUNT(I),K(I),L(I)
2.  READ(I*20)END=100 L*K
3.  FORMAT(4I4+1X6)
4.  KNT=0
5.  DO 30 I=1,10
6.    IOX=K(I)/5
7.    IFREQ(I,IOX)=IFREQ(I,(IOX+1)
8.    IF (IOX.GT.0) KNT=KNT+1
9.  CONTINUE
10.  IF (KNT.EQ.6) WRITE(6,20) L*K
11.  KOUNT(KNT)=KOUNT(KNT)+1
12.  GO TO 10
13.  WRITE(6,119) (1+(IFREQ(I,J)+J*2000)*I=1,10)
14.  WRITE(6,120) KOUNT
15.  WRITE(6,121) KOUNT
16.  STOP
17.  END

END FTN 53 IBANK 3/9 ORANK

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PRINT OUT OF GRID VALUES WITH 6 categories

or greater.
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