REGIONAL LAND COVER CHARACTERIZATION USING LANDSAT
THERMATIC MAPPER DATA AND ANCILLARY DATA SOURCES

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Abstract. As part of the activities of the Multi-Resolution Land Characteristics (MRLC) Interagency Consortium,
an intermediate-scale land cover data set is being generated for the conterminous United States. This effort is
being conducted on a region-by-region basis using U.S. Standard Federal Regions. To date, land cover data sets
have been generated for Federal Regions 3 (Pennsylvania, West Virginia, Virginia, Maryland, and Delaware) and
2 (New York and New Jersey). Classification work is currently under way in Federal Region 4 (the southeastern
United States), and land cover mapping activities have been started in Federal Regions 5 (the Great Lakes region)
and 1 (New England). It is anticipated that a land cover data set for the conterminous United States
will be completed by the end of 1999. A standard land cover classification legend is used, which is analogous to
and compatible with other classification schemes. The primary MRLC regional classification scheme contains 23 land
cover classes.

The primary source of data for the project is the Landsat thematic mapper (TM) sensor. For each region, TM
scenes representing both leaf on and leaf off conditions are acquired, preprocessed, and georeferenced to MRLC
specifications. Mosaic data are clustered using unsupervised classification, and individual clusters are labeled
using aerial photographs. Individual clusters that represent more than one land cover unit are split using spatial
modeling with multiple ancillary spatial data layers (most notably, digital elevation model, population, land use
and land cover, and woody vegetation information). This approach yields regional land cover information suitable for a
wide array of applications, including landscape metric analyses, land management, land cover change studies,
and nutrient and pesticide runoff modeling.

1. Introduction

Many organizations require accurate intermediate-scale land cover information for a variety
of applications. As an example, the National Oceanic and Atmospheric Administration's
(NOAA) Coastal Change Analysis Program (C-CAP, Dobson et al., 1995) has strong
requirements for such information for assessing changes in coastal areas. In this case, the
effects of land cover changes are being investigated with special emphasis on determining
long-term effects on estuarine systems. Similarly, the U.S. Geological Survey (USGS)
Water Resources Division National Water-Quality Assessment Program (Leahy et al.,
1993; National Research Council, 1990) is using medium-scale land cover data as input for
nutrient and pesticide runoff models. This is a concerted effort involving the major
watershed drainage units within the United States. Additionally, the USGS Biological
Resources Division's Gap Analysis Program (Scott et al., 1996) uses intermediate-scale
land cover data to generate detailed data sets mapping natural and semi-natural plant
assemblages. This information is linked with modeled vertebrate habitat preference
distribution data to map (and ultimately manage) biodiversity on a national scale. The field

have 30-m resolution to facilitate maximum use. The MRLC national land cover data can then be incorporated with spatial data, such as the AVHRR, at other scales and resolutions to provide a true multi-resolution land characteristics database. This data set will have the following specifications: (1) there will be a nationally consistent hierarchical legend, (2) final data will be maintained at a minimum spatial resolution of 30 meters; (3) the data set will be produced and stored in a generic raster data format; (4) the data set will include the classified and labeled land cover data, appropriate ancillary data, and metadata documentation; and (5) data will comply with Federal Geographic Data Committee standards. In addition to these characteristics, all MRLC data will be easily accessible to the user community. To this end, the MRLC is developing Internet access as well as conventional delivery routes, such as Compact Disc or tape media.

The MRLC elected to execute its national land cover initiative using a template of 10 Standard Federal Regions as defined by the April 4, 1974, Executive Order OMB Circular A-105. The first "pilot" regional data set was completed for Federal Region 3, which includes the States of Pennsylvania, West Virginia, Virginia, Maryland, and Delaware. Federal Region 2 (New York and New Jersey) has also been completed, and classification work is currently underway in Federal Region 4 (the southeastern United States). Initial land cover mapping activities are underway in Federal Regions 5 (the Great Lakes region) and 1 (New England), and it is projected that land cover generation for the eastern United States will be completed during 1998. It is anticipated that a land cover data set for the entire conterminous United States will be completed by the end of 1999.

3. Data Sources

The primary source of data for this effort is Landsat TM data acquired in 1991, 1992, and 1993 for the MRLC (Loveland and Shaw, 1996). As part of this effort, data sets have been destriped, terrain-corrected using the 3-arc-second digital terrain elevation data (DTED), and georegistered using ground control points, resulting in a root mean square registration error of less than 1 pixel (30 m). Both leaf-on and leaf-off TM data sets are being analyzed.

Other intermediate-scale spatial data are being used as ancillary information in the analysis, including DTED (U.S. Geological Survey, 1993) and derivative DTED products (slope, aspect, and shaded relief), population density data at the census block level (Bureau of the Census, 1991a and b; 1992), Land Use and Land Cover (LUDA) data, and National Wetlands Inventory (USDI, U.S. Fish and Wildlife Service, 1996) data. Additionally, available water capacity and organic carbon (0-40 cm depth) data from the State Soil Geographic (STATSGO) Data Base (U.S. Department of Agriculture, 1994) are being used. Land cover information from various state or national programs, such as the USGS Biological Resources Division Gap Analysis Program (Scott et al., 1996), are being incorporated when appropriate.