

Land Cover and Landscape Ecology

Many applications of forestry and natural resources require accurate land cover and change analysis. Changing conditions due to urban sprawl and increasing forest fragmentation make land cover and change analysis an extremely important consideration in natural resource management and planning.

Forest fragmentation is a critical concern. Spatial analysis of fragmentation is crucial to understanding its impacts on several ecosystem attributes, including ecosystem and species diversity, forest productive capacity, forest health, conservation of soil and water resources, and nutrient cycling. These in turn impact socio-economic conditions and forest management (Alig et. al. 2000). GIT has been very beneficial in the development of novel approaches to analyzing forest fragmentation. A recent project illustrating "percolation theory" used LANDSAT TM imagery from Louisiana's GAP data, in addition to SPOT satellite imagery and color infrared photography to support this approach. Percolation theory concerns the statistical probabilities of landscape connectedness (Lorenzo et. al. 2000). To date, at least 16 SFOs are using GIT to address land cover and land change, with satellite imagery accounting for over half of the RS data used for this application.



Alaska

Satellite remote sensing has been employed by the Division of Forestry for use in land cover and change analysis. LANDSAT TM imagery has been historically used in various cooperative state and federal efforts, but to a limited extent. However, the Tanana River Erosion Study will make greater use of this technology for a specific geographic area.

The Division and the Tanana Chiefs Conference are performing change analyses of the River's channel locations based on comparing 1978 aerial photographs with 1998 satellite imagery of the channel. This study will analyze river bank erosion patterns and address forest and fishery management issues impacted by erosion. Specific areas of investigation include acreage losses in various cover types, large woody debris (LWD) recruitment rates, and relative bank stability along different sections of the river.



Maryland

Maryland's DNR recently received a NASA grant to conduct a cooperative project with the Mid-Atlantic Regional Earth Science Applications Center (MA-RESAC) at the University of Maryland (UMD). The project will utilize MA-RESAC products, including land cover maps created using LANDSAT 7 imagery, and additional imagery and methods to assess land use change, map net primary production (NPP) and conduct high resolution forest mapping. Cover maps will be used to identify patterns of forest fragmentation and changes in forest cover from the mid-1980s to the present. DNR management activities will then be determined based on the spatial attributes of forest distribution. In addition, the project includes a demonstration of LIDAR imagery which will produce digital surface elevation models (DEMs) and forest height and biomass maps.



California

One of the responsibilities of the California Department of Forestry and Fire Protection (CDF) and its Fire and Resource Assessment Program (FRAP) is land cover analysis, and the assessment of current conditions and trends across ownerships for California's forests and rangelands. FRAP is co-located with the USFS for the purpose of seamless vegetation mapping and monitoring. The California Land Cover Mapping and Monitoring Program carried out by FRAP and the USFS uses a coordinated schedule to integrate past vegetation mapping, use of LANDSAT imagery to monitor and determine the causes of vegetation changes over five-year increments, and the remapping of vegetation for areas with significant land cover change. This program provides the most cost-effective method for capturing high quality vegetation and monitoring data across all ownerships in the state. Final mapping products include species groupings, tree sizes and tree canopy closure. Applications include assessing existing policy effectiveness, evaluating watershed cumulative impacts, tracking forest health trends, mapping hazardous fuels, and modeling wildlife habitat.



Kentucky

A collaborative effort to assess land cover change is recently underway in Kentucky. The Office of Geographic Information (OGI) was awarded a \$1.3 million NASA grant for the "Kentucky Landscape Snapshot Project." The goal of the project is to gain a clearer picture of forest, urban and rural landscape in Kentucky. It is being conducted with several agencies, including the Division of Forestry, other parts of the DNR, the USFS, Morehead State University, Space Imaging, and the USGS EROS Data Center. The project was initiated in early 2002 and involves the use of satellite data to generate land cover maps for the entire state. These maps will be compared with early versions and analyzed to determine land cover change. One potential Division application of project data involves the analyses of annual rates of growth for all Kentucky forests for economic and commercial uses, which may provide more accurate estimates for overall forest productivity and landowner returns.



Wisconsin

The Wisconsin Division of Forestry and its parent, the DNR, have actively participated in development of the Wisconsin Initiative for Statewide Cooperation on Landscape Analysis and Data (WISCLAND). WISCLAND is a voluntary partnership of public and private entities facilitating the development of several statewide themes. WISCLAND coordinated the completion of a statewide rural land cover dataset interpreted from LANDSAT 7 TM images that was extensively verified using field crews. Division and departmental cooperation with federal agencies include efforts that developed ecological classification systems consistent with the National Hierarchical Framework of Ecological Units (NHFEU) and ecoregion mapping. WISCLAND results are being used for several applications including by the Division for cartographic display of cover type and land use information, comparison with General Land Office records for change analysis, use with the FIA program for patch size determination, and estimation of fuel types for fire modeling.



Delaware

Although the Delaware Forest Service does not use GIT for land cover or change analysis, it does make use of data produced through such efforts. Its parent, the Delaware Department of Agriculture (DDA), has a joint land cover project with several other entities to map high quality agricultural and natural resource land on the Delmarva Peninsula. These data allow the Forest Service to prioritize and target land acquisition funding and landowner assistance work.



New York

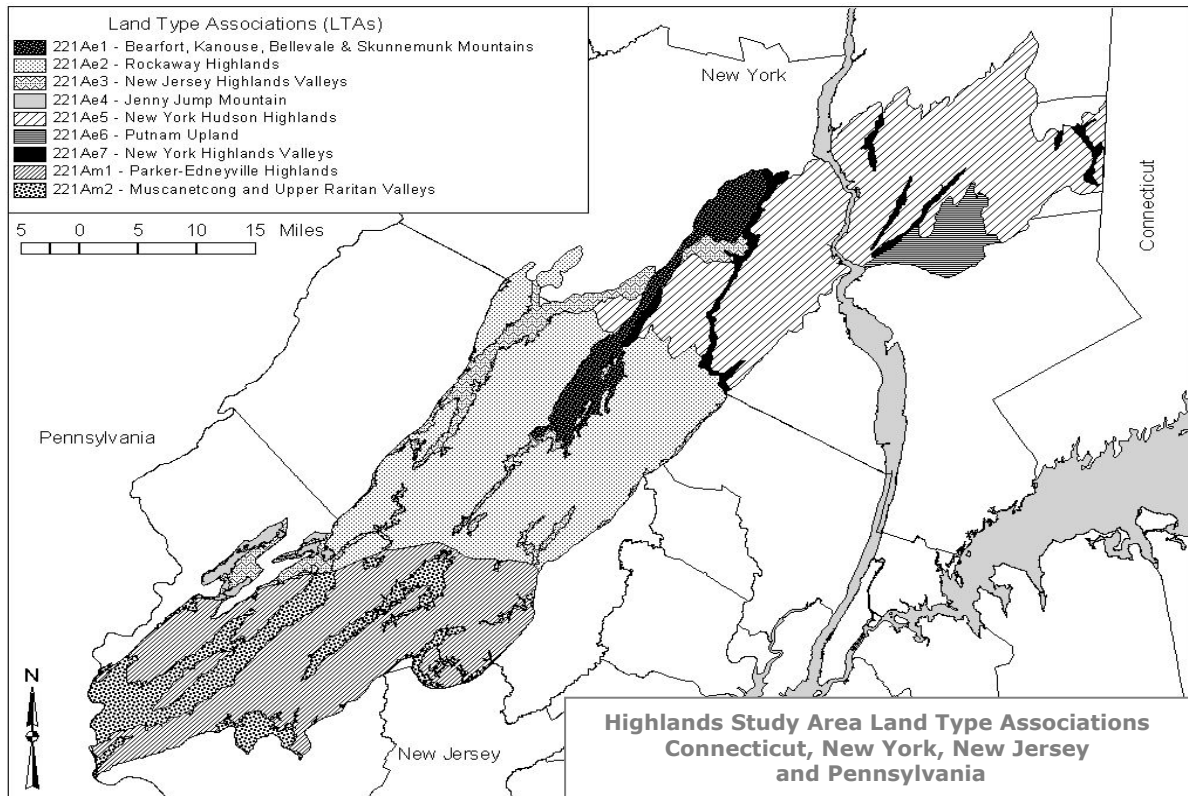
The Division of Lands and Forests is participating in the USFS New York-New Jersey Highlands study. The current study is an update to the original project undertaken in the early 1990s. The study includes analyses of forest fragmentation, watershed conditions, and biological diversity. The EcoMap component of the new study is both a national and regional USFS initiative to map ecological units and encourage their use in ecosystem-based approaches to forestland conservation and management. EcoMap mapping criteria are outlined in the National Hierarchical Framework of Ecological Units (NHFEU), which systematically divides the country into progressively smaller areas of land and water that have similar physical and biological characteristics and ecological processes.

Image below:

Source: New York Division of Lands and Forests

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The Division is using GIS and a combination of several data sets to map Land Type Associations (LTAs), which are one of several ecological units of the NHFEU. Raster data sets used include The Nature Conservancy's Ecological Land Units (ELUs), landform and slope derived from 10-meter digital elevation models (DEMs), and the USGS MultiResolution Land Characteristics (MRLC) data, which are based on LANDSAT TM imagery. Vector data include 1:250,000 surficial and bedrock geology, and STATSGO soils.

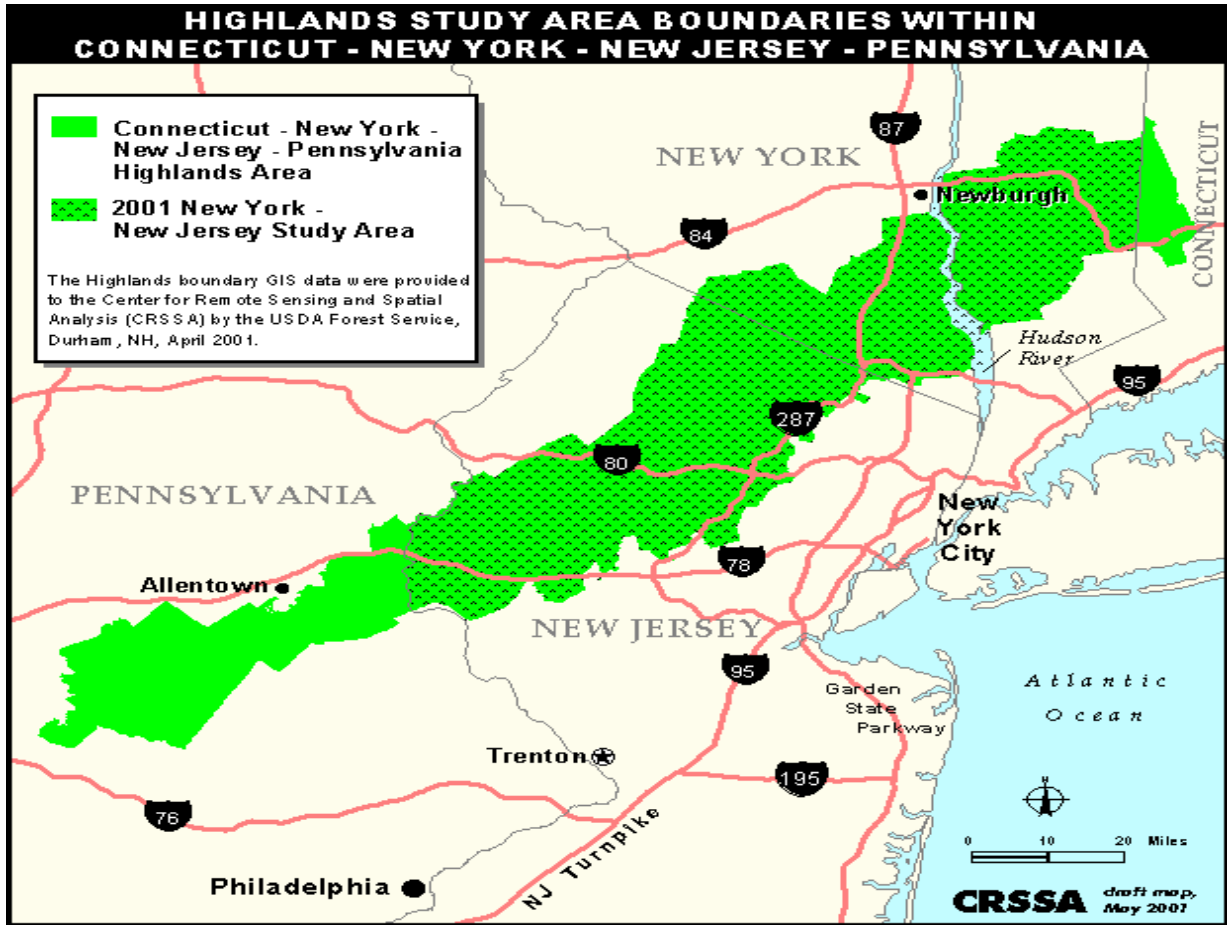
DEC also uses LANDSAT TM and SPOT satellite imagery from the Highlands study in its evaluation of land use change patterns and categorization into ecological land types. This imagery is produced by the Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University, which is a contributor to the Highlands study. CRSSA is conducting several types of analyses, including land use and land cover change, forest and watershed integrity, hydrologic systems, biodiversity, recreation and open space, population trends and projected future growth. Several additional agencies are also involved in the study, including the USGS, the New Jersey Department of Environmental Protection, and the New York-New Jersey-Connecticut Regional Plan Association.



The Division of Parks and Forestry is involved in the USFS New York-New Jersey Highlands study, as described above. The study includes analyses of forest fragmentation, watershed conditions and biological diversity. The Division is using GIS to help analyze these data, identify updated conditions, and improve decision making for management of this geographic area.

Image below:

Source: New York - New Jersey Highlands Regional Assessment Update - CRSSA, Rutgers University
<http://crssa.rutgers.edu/projects/highlands/>









 *New Hampshire*

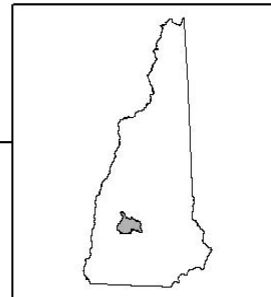
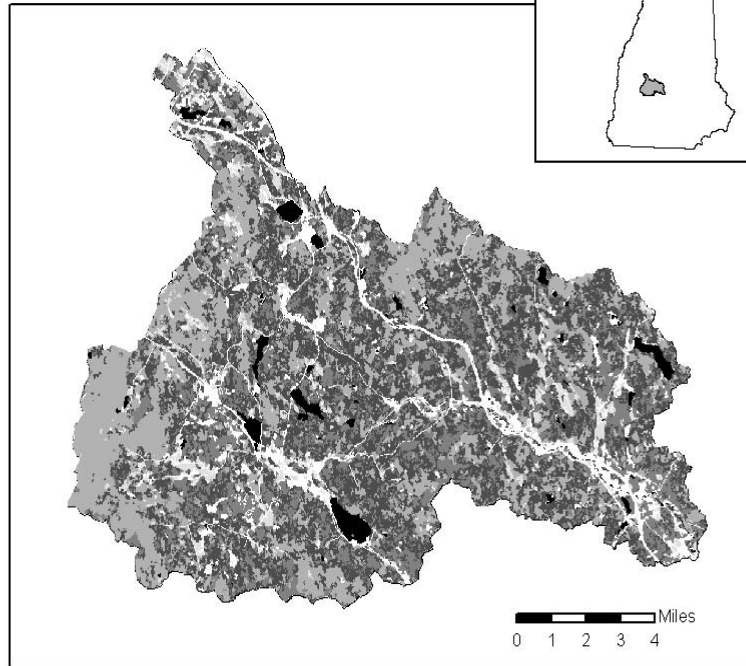
The Division of Forests and Lands utilizes GIT, but most GIT work is conducted under contract with the Complex Systems Research Center (CSRC) at UNH's Institute for the Study of Earth, Oceans and Space. CSRS recently completed an extensive Land Cover Assessment Project with funding and assistance from the Division, the Department of Fish and Game, the USFS, and others. The Division provided financial support as well as a forester to help conduct field verification of the imagery.

The project generated a digital statewide 23-class land cover data set, developed from LANDSAT TM satellite imagery acquired over the period 1990-1999. This data set includes detailed information about the state's vegetative and physical features. A supplemental product of the project is a body of field data focused on the state's forested areas, which provides a valuable data resource for a wide variety of users. The Division has recently contracted for additional work beyond the completion of the project.

Image below:
Source: Complex Systems Research Center
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New Hampshire Land Cover Assessment Project: *The Warner River Watershed*

- CLASS**
-  Developed
 -  Agriculture/cleared
 -  Water/wetland
- Forest**
-  Deciduous
 -  Coniferous
 -  Mixed



0 1 2 3 4 Miles