Biomass Estimation Using LiDAR data in North Carolina

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Introduction

Protecting and monitoring forests throughout the world is an essential part of the international effort to reduce greenhouse gas emissions in the fight against global warming. Quantifying above ground biomass in forest ecosystems is critical for terrestrial carbon cycle and further develops a capacity for monitoring carbon stocks over time. Airborne laser scanning (LIDAR), a high-resolution active remote sensing technology that uses light in the form of a pulsed laser to densely sample the earth's surface, provides an accurate and efficient measurement of three-dimensional forest structures over an extensive area.

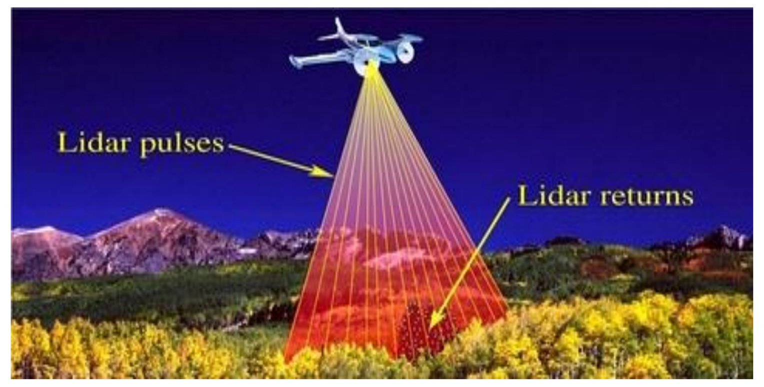
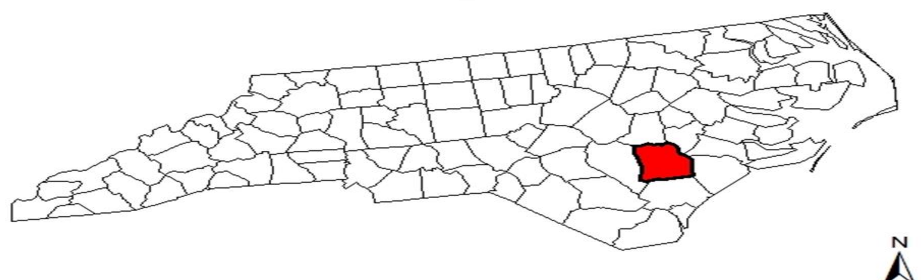


Image source: *sensorsmag.com*

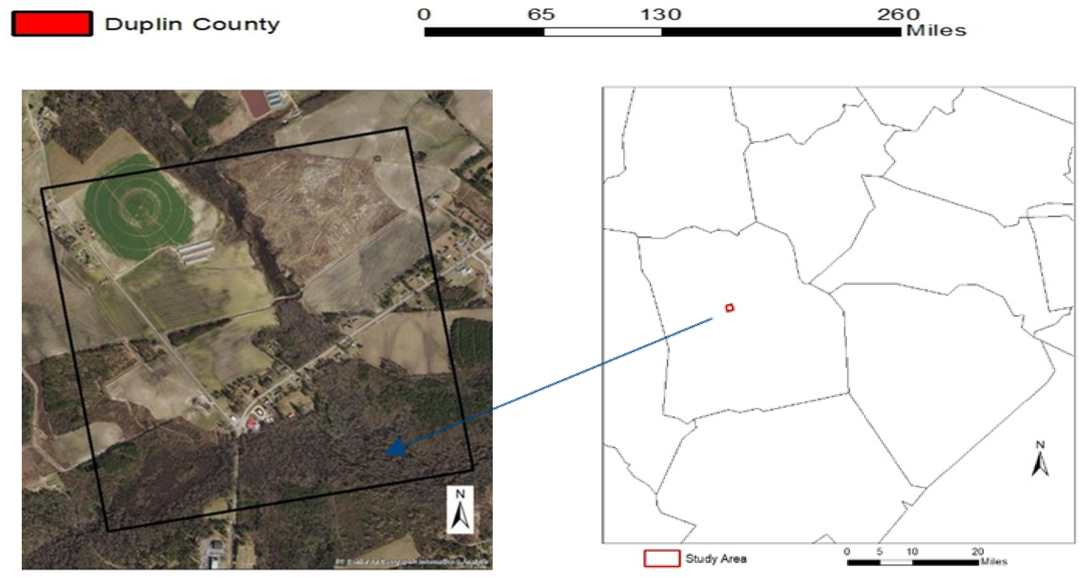
Objectives

The aim of this study is to calculate forest acreage and to estimate biomass in North Carolina with an end-goal of performing economic analysis of NC woodlands.

Study Area



The study area covers a random 230-hectare area in Duplin County, North Carolina.



The datasets used in this study are:

1. NCDL and CDL (2011)
2. LiDAR datasets acquired March through April 2005 (FIRS) and QL2 LiDAR collected from 2014 to present covering all counties in North Carolina with 2 points/m resolution

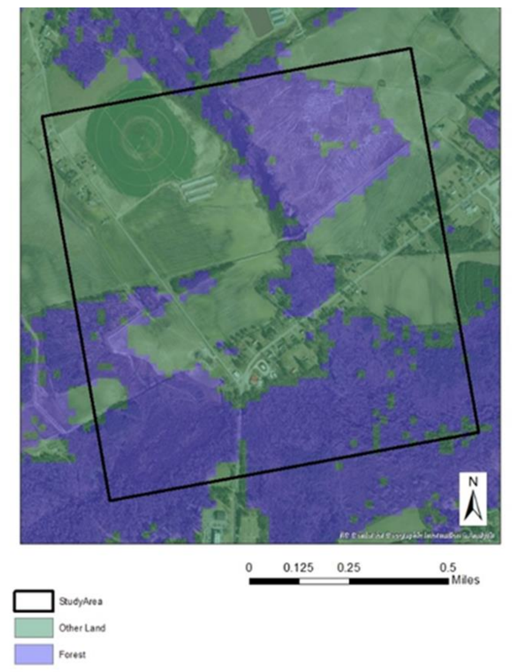
Methods

Analysis involves four steps:

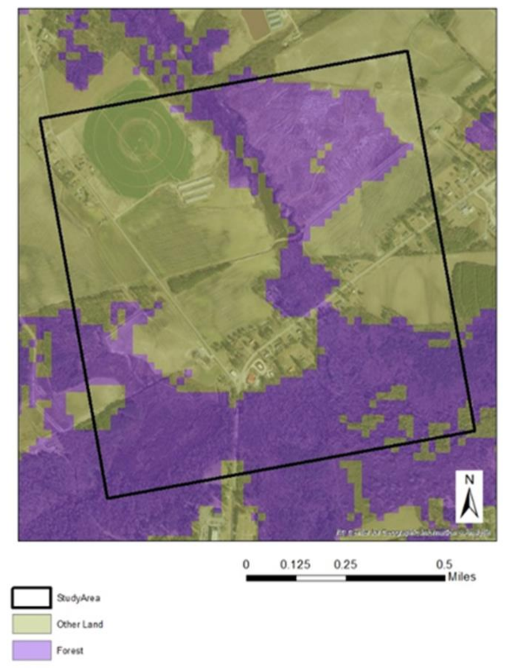
1. Comparison of the study area of forest land location and acreage estimates derived from NLCD and CDL.
2. Using LiDAR data validating and resolving any inconsistencies in forest land estimation
3. Developing and applying a framework to measure the vertical structures of the canopy (calculating canopy density and height, and biomass estimation)
4. Estimating forest biomass available in the study area by combining the estimated forest land area; canopy height and density; and known distributions of the diameter of trees in the area encompassing the study area

Results

1. CDL vs. NLCD data comparison



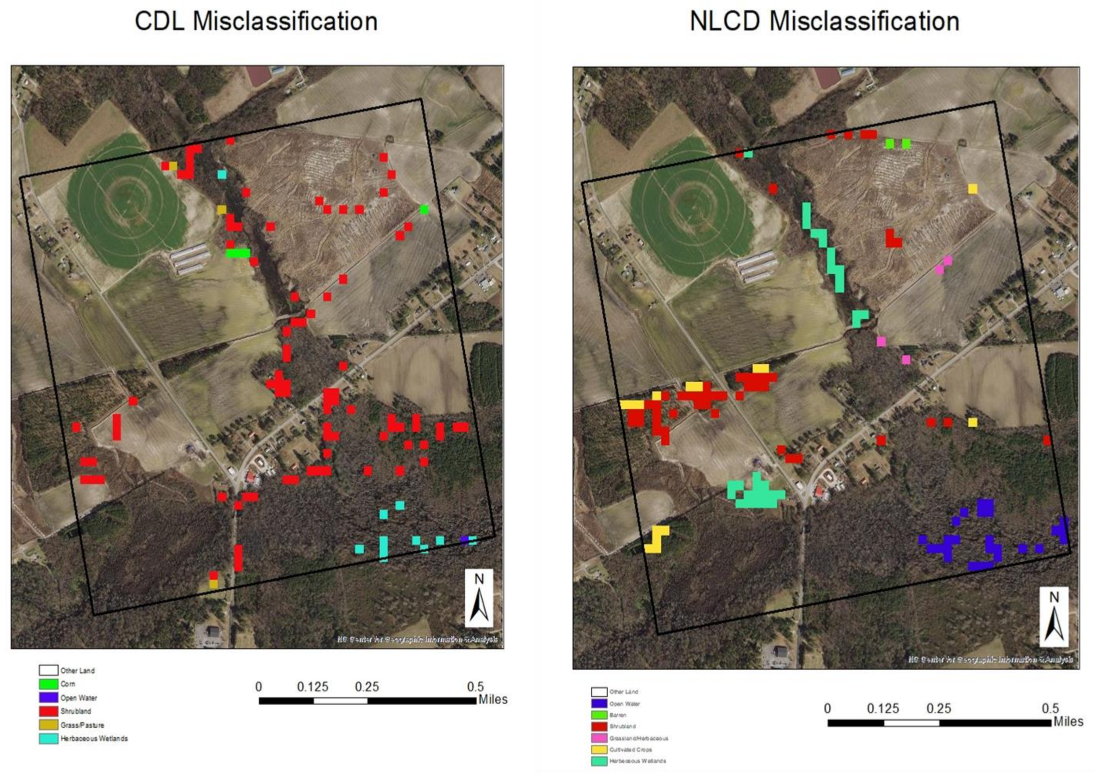
CDL forest land



NLCD forest land

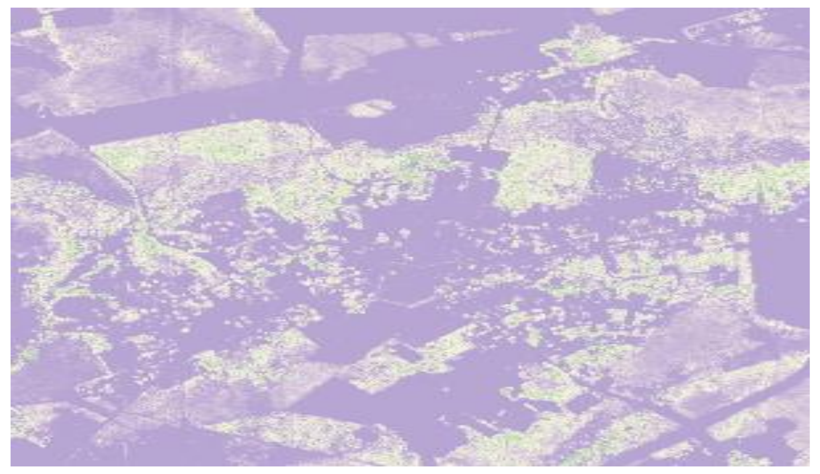
The maps show the locations of forest land of CDL and NLCD. The highlighted parts show Some areas of data inconsistency.

2. The map generated to show the distribution of misclassified land for both datasets



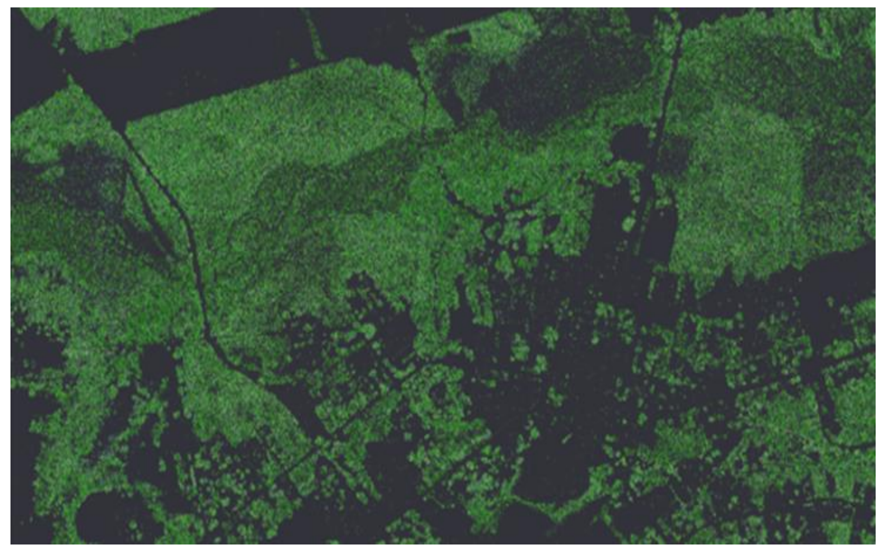
In CDL, most of the misclassified land was reported as Shrubland, whereas In NLCD was Shrubland, Wetlands and Open Water

3. Estimated Forest Canopy Height



The canopy height is determined by subtracting the bare earth surface and digital surface model

4. Estimated Forest canopy density and biomass



The density of the canopy is estimated by comparing the number of vegetation points to the total number of points.

Biomass is estimated based on the model developed by USDA (2005) for individual trees in forests within the United States to develop the carbon budget.

Conclusions

Our estimates supplement and complement those relying solely on the survey-based, USDA Southern Research Station's Forest Inventory and Analysis data, collected yearly on one fifth of the state's forest area. The developed methodology and forest biomass estimation underscore the importance of comparing, reconciling, and combining of alternative data sources for forest biomass estimation.

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