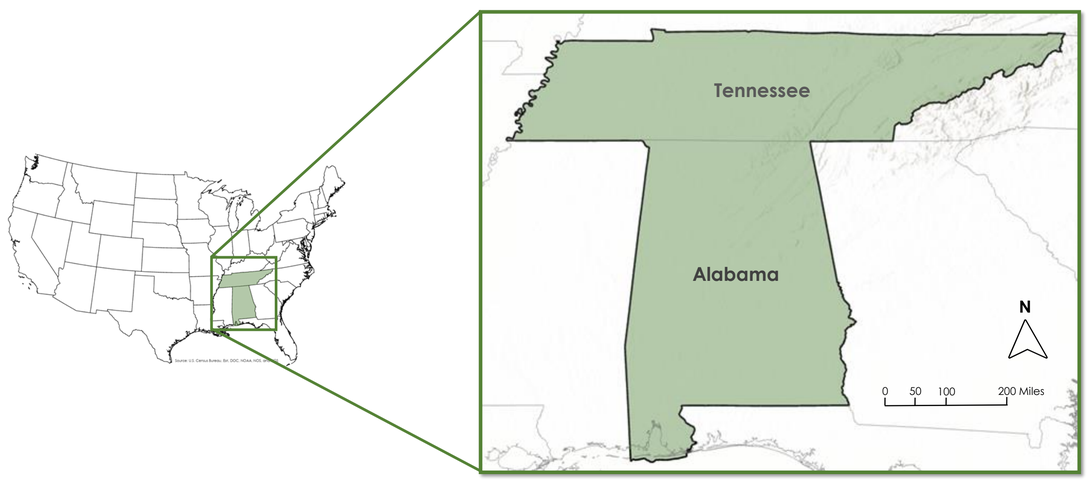
Southeast US Climate II

Leveraging Earth Observations to Estimate Carbon Dioxide Emissions from Forest Cover Loss in Alabama and Tennessee

Abstract

The balancing of atmospheric carbon dioxide (CO_2) sources and sinks is fundamental to curbing climate change. Forests draw CO_2 from the atmosphere and accumulate carbon in tree biomass and soil over time, but forest loss releases the carbon stored in aboveground biomass (AGB) back to the atmosphere. This project assessed the feasibility of using different earth observations to quantify CO_2 emissions from forest cover loss across Alabama and Tennessee. The team generated four maps of stable forest and forest cover loss from 2016 through either 2019, 2021, or 2022, using data from Landsat 5 Thematic Mapper, Landsat 7 Enhanced Thematic Mapper Plus, and Landsat 8 Operational Land Imager, and open-source land cover datasets, and validated the maps using Sentinel-2 satellite imagery. The Global Ecosystem Dynamics Investigation (GEDI) and Advanced Topographic Laser Altimeter System satellite light detection and ranging instruments measured tree canopy height, yielding AGB density estimates. The team calculated average annual CO_2 emissions from forest cover loss, based on forest loss area and average AGB density of stable forest per county. Validation showed that emissions calculated using the National Land Change Dataset for forest cover loss and GEDI for AGB density were most accurate. The team's partners — the Land Trust of North Alabama, Alabama Forestry Commission, American Forest Foundation, Tennessee Department of Air Pollution Control, and Tennessee Division of Water Resources — can compare these remote sensing results against existing ground-based observations to help inform where to focus forest management resources to minimize CO_2 emissions from forest loss.

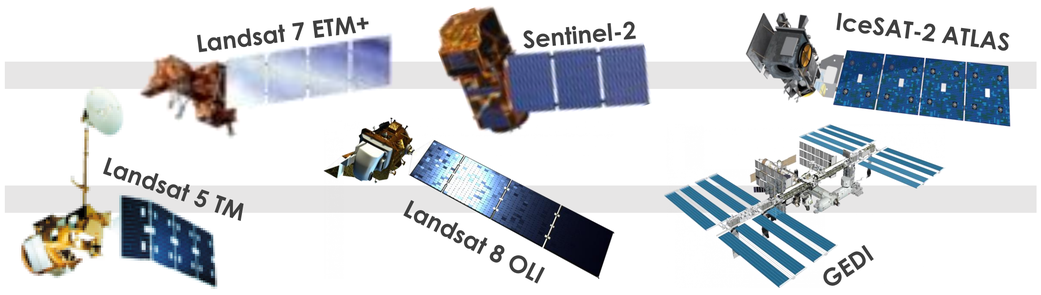
Study Area



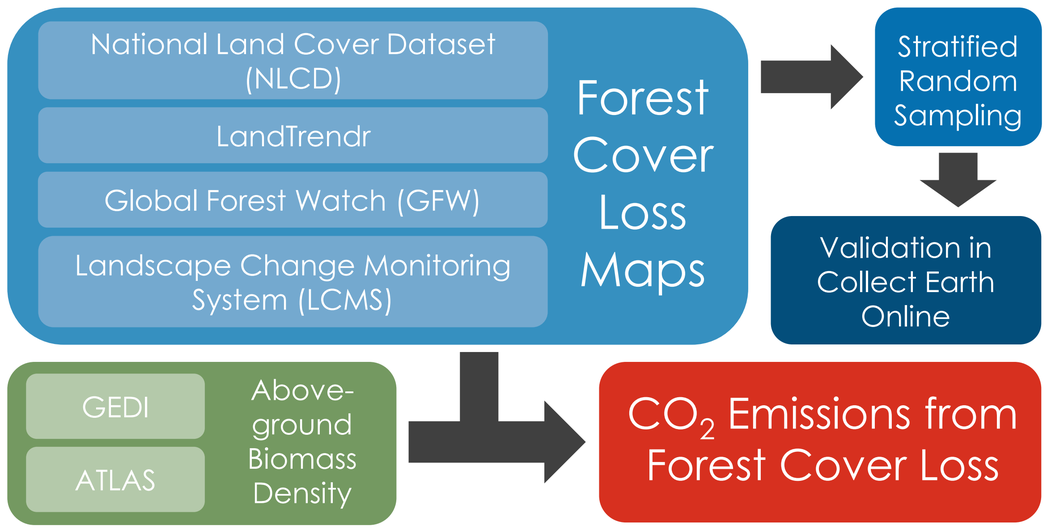
Objectives

- **Generate** forest cover and forest loss maps using Landsat satellite data and open-source land cover datasets
- **Validate** forest cover loss from four different land cover datasets using Collect Earth Online
- **Calculate** CO_2 emissions from forest cover loss and AGB density to inform partner organizations' forest management practices

Earth Observations

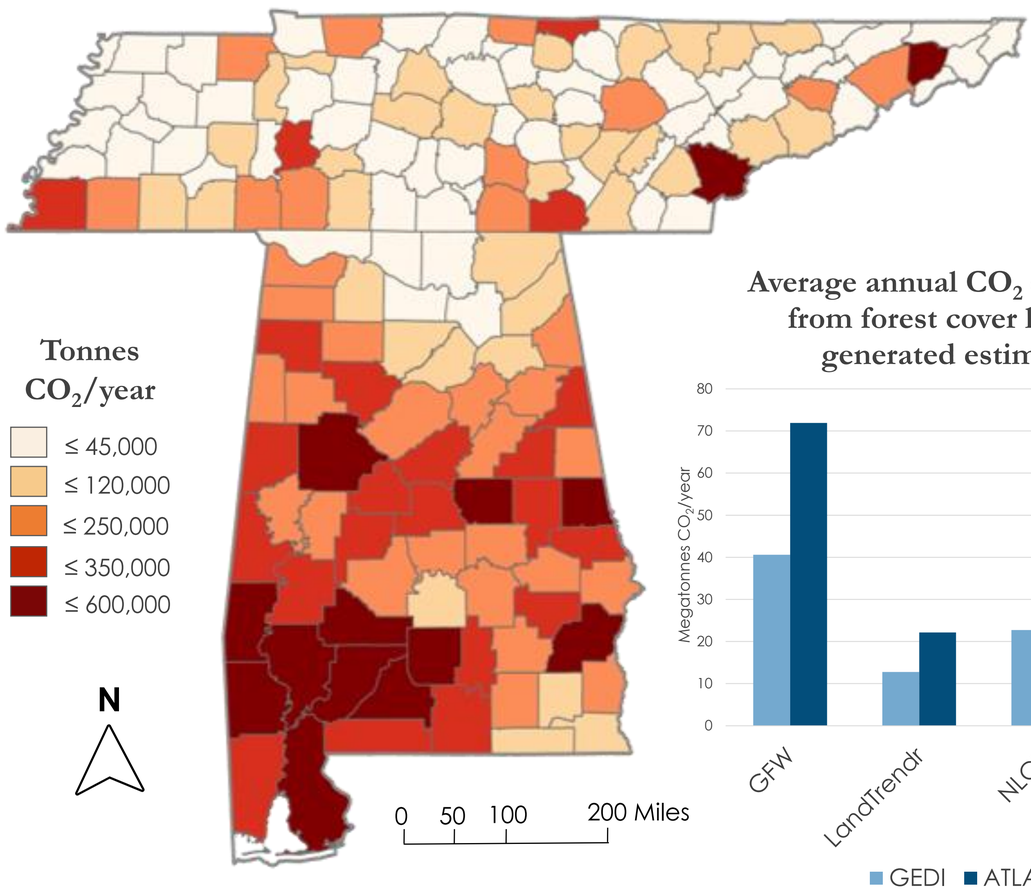


Methodology



Results

Average annual CO_2 emissions from forest cover loss per county, 2016 – 2019
using NLCD forest cover loss map & GEDI AGB density



Average annual CO_2 emissions from forest cover loss, all generated estimates

Conclusions

- The highest CO_2 emissions were in Southern Alabama, which is consistent with pine plantations being harvested in that area.
- The NLCD-based forest cover and loss map had the highest accuracy: 86%.
- Estimated CO_2 emissions vary depending on dataset, and the most suitable dataset will vary between different regions.

Project Partners

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Alabama Forestry Commission	Land Trust of North Alabama	American Forest Foundation	Tennessee Division of Air Pollution Control	Tennessee Division of Water Resources

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