# Improving lidar techniques for measuring diverse longleaf pine forests

Light detection and ranging (lidar) is a technology for measuring elements of forest structure such as basal area, wood volume, and biomass. Scanning a forest with lidar creates a 3-D cloud of points that represent forest vegetation (Figure 1). Because lidar can be collected from airplanes, it can cover large areas and reach remote places, allowing data collection from forests where field-based surveys are challenging.

Methods for lidar data processing are often fine-tuned for a specific forest type. But these methods may not transfer when applied to new forest types. Older methods use area-based measurements which summarize information from lidar point clouds (such as average point height). This is then calibrated to sampling plots on the ground where wood volume is known. However, newer approaches combine area-based information with information from 3-D pixels known as voxels to provide richer information that is more transferable to diverse forest types.
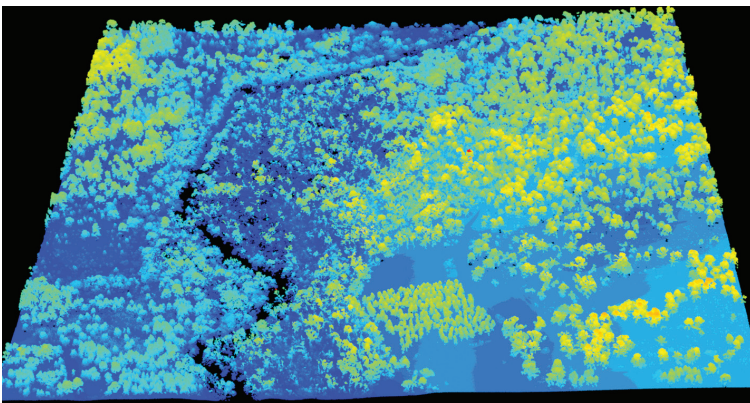
A lidar point cloud from a longleaf pine forest in Newton, GA.

The structure of a longleaf pine forest is variable and can change along topographic features such as ridges and slopes. We tested whether including voxel-based methods improves predictions from lidar data in longleaf pine forests. We predicted wood volume in nine longleaf pine forest types using only area-based information. Then, we predicted it again using both area- and voxel-based information. Adding voxel information improved estimates of wood volume. It also made estimates more transferable across diverse forest types. This

is because voxel-based methods better distinguish the open conditions beneath the canopies of longleaf pine forests from the dense conditions beneath hardwood-dominated forests.

Lidar data are becoming widely available across the U.S. Georgia and Florida have both recently collected statewide lidar. Widespread availability of lidar data can allow researchers to monitor longleaf pine forests over much of their range. Because voxel-based methods require little field-based data for ground truthing, this method is useful for monitoring ecologically and economically important forest types.

MORE INFORMATION

Whelan, A. W., Cannon, J. B., Bigelow, S. W., Rutledge, B. T., & Sánchez Meador, A. J. (2023). Improving generalized models of forest structure in complex forest types using area- and voxel-based approaches from lidar. *Remote Sensing of Environment*, 284, 113362. doi.org/10.1016/J.RSE.2022.113362

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KEY POINTS

A new technique better utilizes the 3D information from lidar data to improve forest measurements in longleaf pine forests.

Using data from voxels reduces the need for ground sampling to calibrate lidar data, improving the efficiency of data collection.