A NOVEL APPROACH TO QUANTIFYING THE FOREST FUELBED USING GROUND-BASED LIDAR

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Abstract

Ground-based LIDAR is a novel remote sensing technique that may be used to precisely quantify fuelbed characteristics that are otherwise difficult to measure and are important drivers of forest fire behavior. We measured vegetative fuel properties found within the pine woodland

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understory of the southeastern U.S. A mobile terrestrial LIDAR unit was used to collect sub-cm three-dimensional laser data for individual fuel types (shrubs) and heterogeneous fuelbed plots. Spatially explicit point-intercept field fuel sampling was used to determine fuelbed heights and volume, while leaf area and biomass measurements of whole and sectioned shrubs were calculated from destructive sampling. We used a mathematical code to estimate volume from LIDAR data. This was compared to traditional methods, which assume a volumetric geometry (cylinder or spheroid). We found that traditional methods overestimate volume for specific fuel types due to variation in leaf area distribution. Therefore, the assumed geometry of vegetation may be coarse and unreliable for estimating volume, while LIDAR captures all of the plant's structural complexities. LIDAR volume estimates were highly correlated with biomass and leaf area for individual shrubs when factored by species, size, and plant structural section. A variogram analysis illustrated that fuelbed heights were highly variable among the fuelbed plots, and ground LIDAR was more sensitive to height variations than traditional point intercept sampling. Using ground LIDAR is a new and promising approach to obtaining reliable volume estimates of complex surface fuels that can be applied to important fire behavior modeling variables used in forest fire management.

[Abstract Only]