Title: “Opportunities and Challenges of Using FIA Data to Validate Biomass Maps from LIDAR: Results from a Case Study in Maryland”

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Abstract: Validation of biomass estimates is essential for accurately mapping forest biomass and understanding terrestrial carbon cycle processes. Forest Inventory and Analysis (FIA) data is a valuable resource for validating LIDAR-derived aboveground carbon maps if uncertainties inherent to the data are appropriately addressed. FIA plots consistently measure aboveground biomass with well documented methods, are spatially unbiased at large scales, and are straightforward to replicate for augmenting sample sizes. However, applying FIA data for LIDAR studies is challenging in several ways, including hidden and/or inaccurate geolocations of the plots, lack of representation of biomass in “non-forest” areas, and unknown accuracy of biomass equation models. The current study provides estimates of aboveground carbon at the plot and county scales for two counties in Maryland. Biomass model uncertainty was accounted for by applying multiple sets of allometric models and simulating and propagating error structures. For example, the total aboveground carbon (kgC) for 25 plots differed by as much as 13% depending on whether general or specific equations were used. Further, although understory species (sweetgum, blackgum, and southern red oak) accounted for 14% of the total biomass, no species-specific equations were available, obligating the use of less accurate general models. Thus, when using FIA data for validation of LIDAR biomass maps, it is important to evaluate the uncertainty in the FIA measurement data itself. Further, the uncertainties in biomass equations models become less serious with larger scales, such as a county. However, at the same time, biomass carbon estimated by FIA plots at larger scales is potentially less accurate than LIDAR-estimated carbon because the latter method should better represent spatially heterogeneity of biomass. As a result, it may be more meaningful to use FIA data as a “comparison” rather than a “validation” for LIDAR biomass carbon estimates at large spatial scales.