PIs and Affiliations:

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Project Title:
Incorporating spatial dependence and measurement error when estimating county level forest biomass.

Period for Report:
January 1, 2025 – June 30, 2025

Progress:
The project is progressing as planned. During the period from January 16, 2024, to December 31, 2024, Mr. Pratyush Dhungana, a master's student, applied the standard Fay-Herriot (FH) model and its derivatives for county-level aboveground biomass (AGB) estimation using FIA data and multi-source remote sensing data across four FIA regions: South (Mississippi), North (Minnesota), Pacific Northwest (Oregon), and Rocky Mountains (Colorado). The derivatives of the FH model incorporate measurement error in auxiliary data and spatial dependence. Measurement error models have consistently outperformed direct measurements across all states. In Mississippi and Minnesota, where spatial dependence was significant for county-level forest biomass, the spatial Fay-Herriot model showed superior performance. PI Poudel presented these results at the virtual PSAE meeting on January 16, 2025. During the reporting period, to account for the non-linear relationship between biomass and remote sensing variables, Mr. Dhungana applied the Mixed Effects Random Forests (MERF) model and compared it to the Battese-Harter-Fuller (BHF) model. He presented preliminary findings at the Forest Inventory and Analysis (FIA) Science Symposium on November 19, 2024; a comparison of MERF with FH at the 23rd Biennial Southern Silvicultural Research Conference on March 19, 2025, at the Hyatt Regency Hotel in Greenville, SC; and a comparison of MERF with BHF, along with an additional application of the FH model for down-woody-debris (DWM) using FIA data, at the PASE in-person meeting in Missoula on June 25th, 2025.

Next Period Plans:
As next step to our project, we are planning to implement the multivariate FH model and compare them with univariate FH models for DWM and AGB across four FIA regions.

Problems or Delays:
No problems or delays encountered.