

LARGE-AREA FOREST INVENTORY REGRESSION MODELING: SPATIAL SCALE CONSIDERATIONS

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Abstract—In many forest inventories, statistical models are employed to predict values for attributes that are difficult and/or time-consuming to measure. In some applications, models are applied across a large geographic area, which assumes the relationship between the response variable and predictors is ubiquitously invariable within the area. The extent to which this assumption holds for a tree height prediction model was evaluated at regional, ecoprovince, and ecosection spatial scales in the Northeastern United States. Two nonlinear regression models were tested, a spatially-ambiguous model that utilized tree and stand-level predictors, and a spatially-explicit model that incorporated latitude, longitude, and elevation as predictors. Regional-scale models evaluated at the state level showed considerable bias for some states, which suggests the statistical significance of spatial predictor variables does not translate into effective accounting for spatial variability. Similar results were obtained when fitting the models to an ecoprovince and evaluating bias within ecosections. Finally, fitting the models to ecosections within the ecoprovince provided a moderate level of local robustness as assessed by Moran's I statistic; however there are cases where local biases may still exist. The results suggest that models should be developed and applied at small spatial scales to reduce local biases when model predictions are aggregated to larger geographic domains. However, small spatial scales often equate to relatively small sample sizes that can present problems in model fitting and result in increased model uncertainty. Therefore, modelers need to carefully balance the minimizing of spatial extent and obtaining acceptable sample size.

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