Plantation Management Research Cooperative
Warnell School of Forestry & Natural Resources
UNIVERSITY OF GEORGIA

New Project

Forest Modeling Research Cooperative

Integrating SAE methods with stand-level forest inventory and growth projection for southern pine plantations

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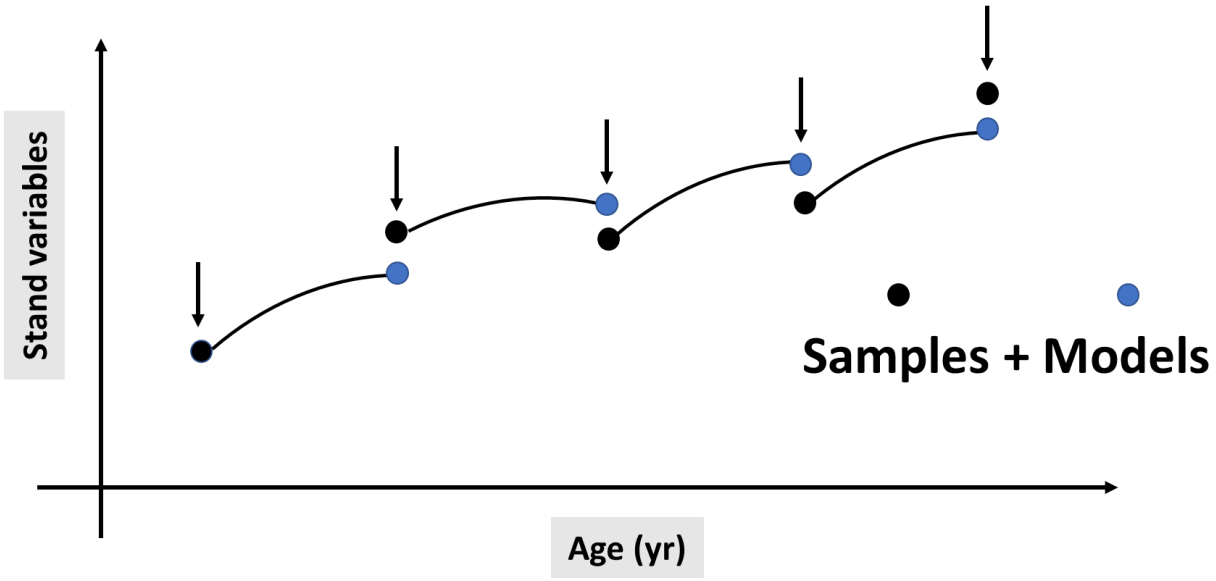
Phil Radtke (VT), Bronson Bullock (UGA)

Justification

Sampling + Model projections →

1. Estimate current stand conditions
2. Project future growth and yield

In a typical operational forest,



Justification

SAE has proven useful to improve the precision level of parameters of interests at finer scales.

With a more precise estimate produced by SAE, the inventory frequency and intensity could be reduced, which can greatly reduce the cost and time devoted to field data collection.

However…

Limited research has focused on **evaluating the integration of SAE estimates in stand-level forest inventory and model projections**, especially for unit-level applications under different forest conditions.

Objectives

Main objective:
To evaluate the applications of unit-level SAE techniques in improving the stand-level inventory and model projection systems for southern pine plantations

Specific objectives:
(1) To evaluate the precision level of total volume using SAE-derived input variables in commonly-used growth and yield systems at different time intervals
(2) To examine the impact of varying levels of ground GPS spatial precision when generating SAE estimates
(3) To investigate the applications of unit-level models, both with and without random effects, especially for predicting tree lists and/or diameter distributions

Methods

Stand Data

Long-term research experiments

- Plantation Management Research Cooperative (PMRC) at UGA
- Forest Modeling Research Cooperative (FMRC) at VT

→ A working example of the proposed methodology

Other datasets:

- FIA sample plots
- PMRC and FMRC members

→

- Validate the methods
- Generate auxiliary variables

Possible auxiliary variables include inventories from previous years and metrics derived from remote sensing data, such as satellite-based multispectral imagery (e.g., Landsat-8, Sentinel-2, NAIP) and various sources of airborne and space-borne lidar data (e.g., 3DEP, GEDI).

Methods

Stand density (e.g., basal area per unit area, trees per unit area) and site index (or average dominant height) are essential input variables for predicting total volume in stand-level growth and yield models.

We will generate SAE estimate for each input variable and evaluate the precision level of total volume at different time intervals (e.g., 1, 3, 5, 10 years after data collection) in several commonly-used growth and yield systems (e.g., PMRC 1996 Model, FASTLob, FVS).

The impact of varying levels of ground GPS spatial precision will be examined when generating SAE estimates.

Methods

SAE unit-level models, both with and without random effects will be examined, especially for predicting tree lists and/or diameter distributions.

- The framework of conventional (or Bayesian) unit-level approaches will be used to estimate random effects using ground plots to increase the precision of direct estimates.

- We will also investigate the synthetic model framework (fixed effects only) and evaluate the potential biases using a validation approach.

Deliverables

(1) Present the results in professional meetings (e.g., CAFS annual meeting, southern and northeastern mensurationists meeting)

(2) Prepare a journal article(s)

(3) Generate a thesis from a master's student and/or one to two chapters of a doctoral dissertation from a PhD student