

Project Title: Toward operational FIA model-based estimation of high-dimensional forest inventory parameters to support inference at user-defined spatial scales.

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Period of Report: January 1, 2025 to June 30, 2025

1 Progress

This has been a productive reporting period. With four papers published, two in press, four in review, and several in preparation.

Published:

1. Itter, M.S., A.O. Finley, and A. Weiskittel. Connecting growth and yield models to continuous forest inventory data to better account for uncertainty. *Forest Ecology and Management*. <https://doi.org/10.1016/j.foreco.2025.122754>.
2. Nothdurft, A., S. Sarkleti, T. Ofner-Graff, A. Tockner, C. Gollob, T. Ritter, R. Krassnitzer, P. Svazek, M. Kuehmaier, K. Stampfer, and A.O. Finley. Small area estimation of growing stock timber volume, basal area, mean stem diameter, and stem density for mountain forests in Austria. *Canadian Journal of Forest Research*. <https://doi.org/10.1139/cjfr-2024-0302>.
3. May, P.B. and A.O. Finley. Spatial-temporal prediction of forest attributes using latent Gaussian models and inventory data. *Spatial Statistics*. <https://doi.org/10.1016/j.spasta.2025.100917>.
4. Peruzzi, M., S. Banerjee, D.B. Dunson, and A.O. Finley. Grid-Parametrize-Split (GriPS) for improved scalable inference in spatial big data analysis. *Bayesian Analysis*. <https://doi.org/10.1214/25-BA1515>.

In press:

1. Itter, M.S. and Finley, A.O. Toward improved uncertainty quantification in predictions of forest dynamics: A dynamical model of forest change. *Ecological Applications*. Accepted. Preprint at: <https://doi.org/10.1101/2024.07.22.604669>.
2. Shannon, E.S, A.O. Finley, P.B. May, G.M. Domke, H.-E. Andersen, G.C. Gaines III, A. Nothdurft, and S. Banerjee. Leveraging national forest inventory data to estimate forest carbon density status and trends for small areas. *Forest Ecology and Management*. Accepted. Preprint at: <https://arxiv.org/abs/2503.08653>.

In review:

1. Doser, J.W., M.S. Itter, G.M. Domke, and A.O. Finley. Multivariate spatial models for small area estimation of species-specific forest inventory parameters. *Forest Ecology and Management*. Preprint at: <https://arxiv.org/abs/2503.07118>.
2. Crisp, A.D. Taylor-Rodriguez, and A.O. Finley. Clustering the Nearest Neighbor Gaussian Process. *Journal of Machine Learning Research*. Preprint at: <https://arxiv.org/abs/2501.10656>.
3. Shannon, E.S., A.O. Finley, and P.B. May. Quantifying impacts of natural gas development on forest carbon. *PNAS*. Preprint at: <https://doi.org/10.1101/2025.06.23.661107>.
4. White, G.W., A.O. Finley, J.K. Yamamoto, J.L. Green, T.S. Frescino, D.W. MacFarlane, and H.-E. Andersen. Hierarchical models for small area estimation using zero-inflated forest inventory variables: comparison and implementation. *Canadian Journal of Forest Research*. Preprint at: <https://arxiv.org/abs/2503.22103>.

On-going work:

- Developing SAE models for change detection and attribution. Current case study focuses on fire impact on timber resources in PNW.
- Development of a multivariate extension to the univariate model noted above. The model formulation and software development is underway and initial results look good.

2 Next Period Plans

Continue progress on all points above. Additionally we are starting work on methods for highly-multivariate spatial and spatial-temporal outcomes, as outlined in the proposal.

3 Problems/Delays

None.