

Nursery Inventory System in Bareroot Pine Seedlings: Possibility of Automated Technologies

Jessica A Maynor¹, W. Patrick Cumbie², Glen Raines³, and Canicius J. Mwitta⁴

¹Tree Improvement & Seedling Quality Coordinator, ArborGen, Ridgeville, SC 29472, USA; ²Direct of Product Development, ArborGen, Ridgeville, SC 29472, USA; ³Adjunct Professor, College of Engineering, University of Georgia, Tifton, GA 31793, USA; ⁴PhD Student, College of Engineering, University of Georgia, Tifton, GA 31793, USA; *jamayno@arborgen.com

In 2020-2021 the southern United States grew 1,147,700,000 seedlings, of which 74.4% were bareroot conifers (854,128,000) (SFNMC Spring Newsletter, 2022, p.2). For seedling providers, accurate inventory of seedlings within a nursery is critical for selling seedlings to landowners and other industry customers. A collaborative project between the University of Georgia and ArborGen sought to develop an automated inventory system for bareroot nursery beds. Using videos of nursery beds were captured over three years (2018-2021), a deep-learning model was created to detect and count seedlings at various growth stages. To examine variation in nursery beds and sampling intensity needed to confidently estimate bed inventory, sample plots were installed in six beds at two nursery facilities in Summer 2022. The automated inventory system on average was 0.53 standard deviations from the sample mean across both nursery facilities. To further test the detection accuracy, 15-foot hand counted control plots were installed in 2022 in production nursery fields and recorded model accuracy from May to August. The accuracy ranged from 42% at the lowest in May to 98% at the highest in late July. Automated inventory system shows promising results in hand counted control plots as well as estimates to bed means. Model improvements are needed to further develop the technology before deployment industry wide.