MWP

MWP – Young Researcher Abstract 2025

Project title: Towards a Digital twin of boreal forest biodiversity	
Author: Joel Kostensalo	
Affiliation: Natural Resources Institute Finland	**E-mail:** joel.kostensalo@luke.fi

Abstract (approx. 200 words)**:** Creating structurally representative country-wide tree maps would be a significant step towards the European Commission's goal of creating a biodiversity-oriented digital twin of the Earth's forests. If the local precision is sufficient, such a digital twin could be also used as a tool for making stand-level management decisions. Individual tree detection applied to airborne laser scanning (ALS) data can be used for mapping, but smaller trees hiding under the tree canopy and clustered trees tend to be undetected, resulting in excess spatial regularity and bias in the size distribution. Furthermore, state-of-the-art species classification algorithms fail when mapping rare species in real forests due to highly suboptimal FDR–FNR-tradeoffs. Using 5–10 pts/m2 ALS data and over 500 field plots, we have developed and validated a method which corrects for missing trees and false detections using a computationally efficient tree-bootstrapping method. The corrected tree maps accurately reproduce the stem number, spatial pattern, and tree height and diameter distributions. The resulting tree map can be used as a decision tool for sustainable management of forests. Wall-to-wall applications covering up to 110 million trees are presented, along with a critical analysis of aspen detection.

Key words: Remote sensing, digital twin, Bayesian statistics