Benchmarking Software Solutions for Forest Inventory from Ground-Based Point Clouds

Carlos Cabo[1,2,3], Natalia Rehush[4], Benjamin Wild[5], Arnadi Murtiyoso[6], Anna Iglseder[5], Markus Hollaus[5], and Martin Mokros[7]

[1]Department of Mining Exploitation and Prospecting, University of Oviedo, Mieres, 33600, Asturias, Spain. carloscabo@uniovi.es

[2]INDUROT, University of Oviedo, Mieres, 33600, Asturias, Spain. carloscabo@uniovi.es

[3]Centre for Wildfire Research, Swansea University, Swansea, SA28PP, United Kingdom. carloscabo@uniovi.es

[4]Swiss National Forest Inventory, Swiss Federal Institute for Forest, Snow and Landscape Research WSL, 8903, Birmensdorf, Switzerland. nataliia.rehush@wsl.ch

[5]Department of Geodesy and Geoinformation, TU Wien, 1040, Vienna, Austria. benjamin.wild@tuwien.ac.at ; anna.iglseder@geo.tuwien.ac.at ; markus.hollaus@tuwien.ac.at

[6]Université de Strasbourg, INSA Strasbourg, CNRS, ICube Laboratory UMR 7357, Photogrammetry and Geomatics Group, 67000 Strasbourg, France arnadi.murtiyoso@insa-strasbourg.fr

[7]Department of Geography, University College London, WC1E 6BT, London, UK. m.mokros@ucl.ac.uk

In the context of the COST Action 3DForEcoTech and an ISPRS scientific initiative, a benchmarking activity was conducted to evaluate the performance of 13 software solutions designed for automated forest inventory using ground-based point clouds. These tools, which serve as digital analogs to traditional forest inventories, were tested on 12 datasets from four distinct forest plots featuring diverse forest types and acquisition methods, including two different Terrestrial Laser Scanners (TLS) and a handheld laser scanner. The experiments, carried at TU Wien (Vienna, Austria) in September 2023, with 15 researchers working on identical computing environments, assessed each software's ability to detect trees, extract the positions, and estimate DBH, along with computational efficiency. Results showed that while most solutions achieved good performance, a few significantly outperformed the rest in accuracy and processing time, whereas others struggled with larger point clouds, highlighting important differences in scalability and robustness. This study provides valuable insights into the current capabilities and limitations of automated forest inventory tools, guiding both researchers and practitioners in selecting the most suitable software for their needs.

Keywords: LiDAR, TLS, Forest Inventory, DBH Estimation, Software Benchmarking, Point Cloud Processing, 3DForEcoTech