Quantifying branch architecture of tropical trees using terrestrial LiDAR and 3D modelling

Alvaro Lau[1,2,*], Lisa Patrick Bentley[3], Christopher Martius[2], Alexander Shenkin[4], Harm Bartholomeus[1], Pasi Raumonen[5], Yadvinder Malhi[4], Tobias Jackson[4], and Martin Herold[1]

[1]Wageningen University & Research, Laboratory of Geo-Information Science and Remote Sensing, Droevendaalsesteeg 3, 6708 PB Wageningen, the Netherlands.

*corresponding author: alvaro.lausarmiento@wur.nl

[2]Center for International Forestry Research (CIFOR). Situ Gede, Sindang Barang, Bogor 16680, Indonesia.

[3]Department of Biology, Sonoma State University, 1801 East Cotati Avenue, Rohnert Park, CA 94928, USA.

[4]Environmental Change Institute, School of Geography and the Environment, South Parks Road, University of Oxford OX1 3QY, UK

[5]Laboratory of Mathematics, Tampere University of Technology Korkeakoulunkatu 10, 33720 Tampere, Finland

Online Resource 3: Quantitative ranking of QSMs

We quantitatively ranked the QSMs from 0 (accurate reconstruction) to 3 (inaccurate reconstruction) based on four criteria:

1. Presence of anomalous or unrealistic branches. We ranked 3 if QSMs had anomalous or unrealistic branches which did not appear in the original point cloud;
2. Absence of a QSM branch. We ranked 3 if QSMs were not able to reconstruct a branch from the tree point cloud;
3. Presence of extra cylinders. We ranked 3 if the QSMs had small cylinders whereas the tree point cloud indicates no presence of branches and;
4. Cylinder closeness to point cloud. We ranked 3 if QSMs cylinders diameter differed from the tree point cloud.

We chose the seven models which ranked the lowest as our best models. This analysis focused on the QSM cylinders at the first branches orders and below the tree canopy. We did not visually inspect branches inside the canopy because point density at this height was not enough for the *TreeQSM* to reconstruct branches properly.