Weighing trees non-destructively from terrestrial LiDAR point-cloud data
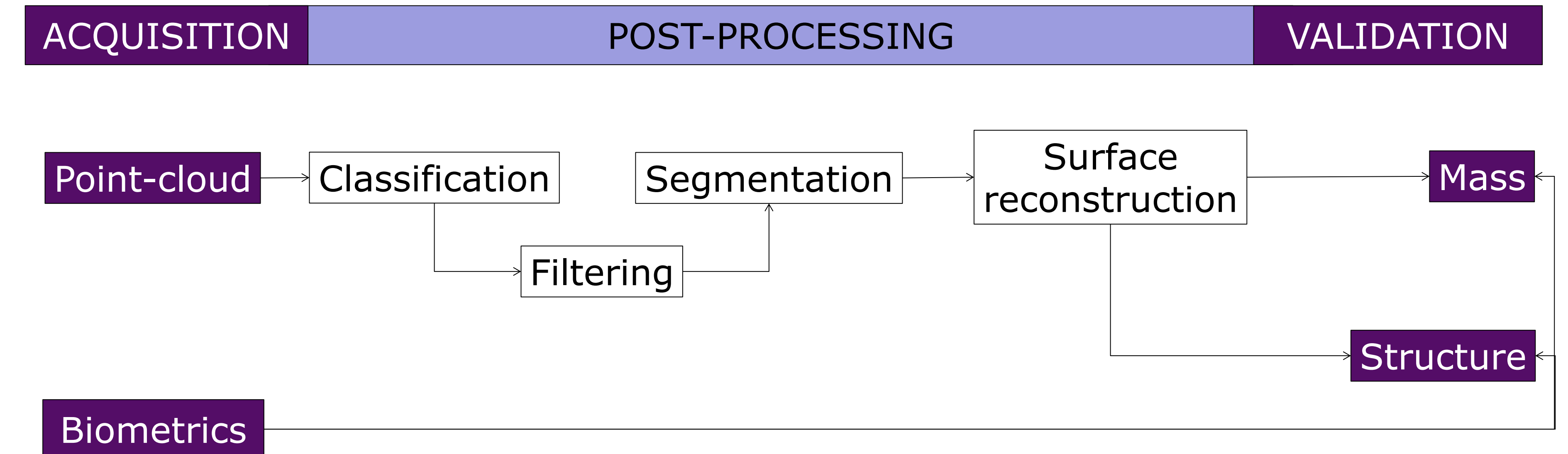
Forest Research

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- **A new method for reconstructing topologically consistent tree structure from terrestrial scanner (TLS) point-clouds is developped. It generates a cylinder model tree structure.**

- **The method is being applied on a mature temperate deciduous forest at the Birmingham Institute of Forest research (BIFoR) Free Air CO_2 Enrichment (FACE) experiment site.**

- **Outputs from this project underpin non-destructive 3D mock-up reconstruction of the six 30m-diameter FACE plots (pre- and post-treatments) for carbon stock assessments and modelling of carbon dynamics with unprecedented levels of detail and accuracy.**
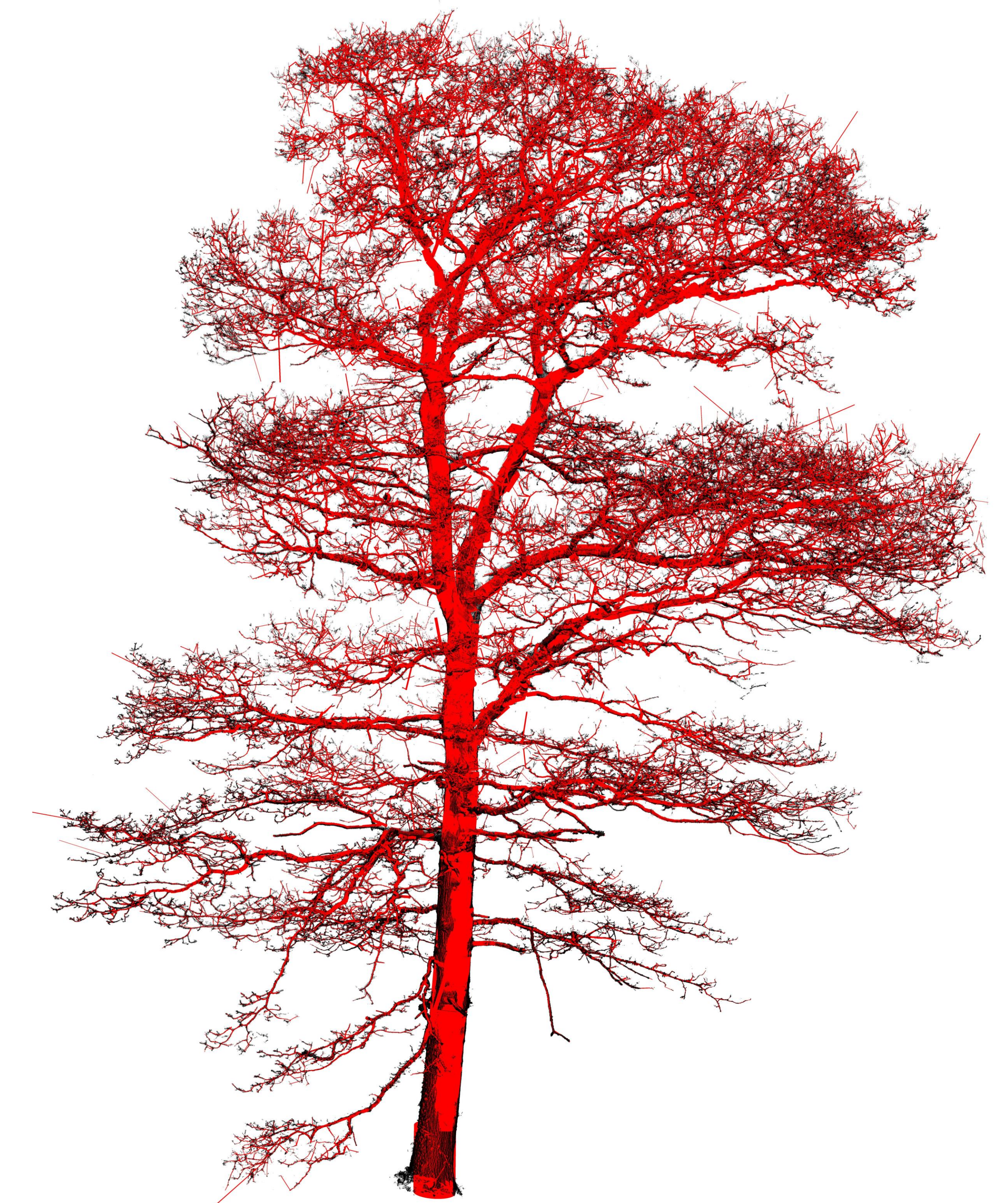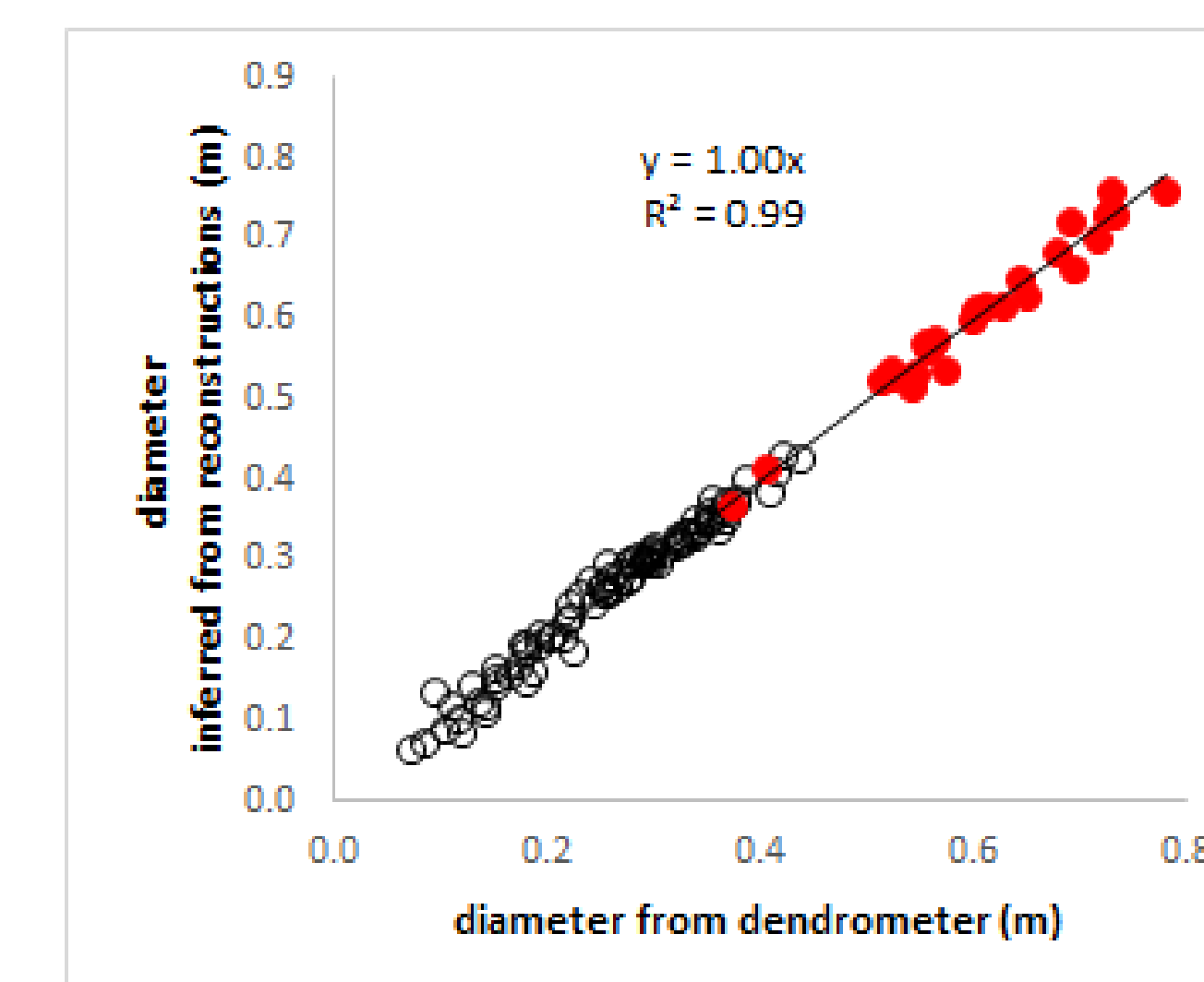
ACQUISITION — POST-PROCESSING — VALIDATION

Point-cloud → Classification → Filtering → Segmentation → Surface reconstruction → Mass / Structure

Biometrics

The main steps of the method

TLS point-cloud acquired in 2015

TLS point-cloud acquired in 2018

y = 1.00x
$R^2 = 0.99$

diameter inferred from reconstructions (m) vs diameter from dendrometer (m)
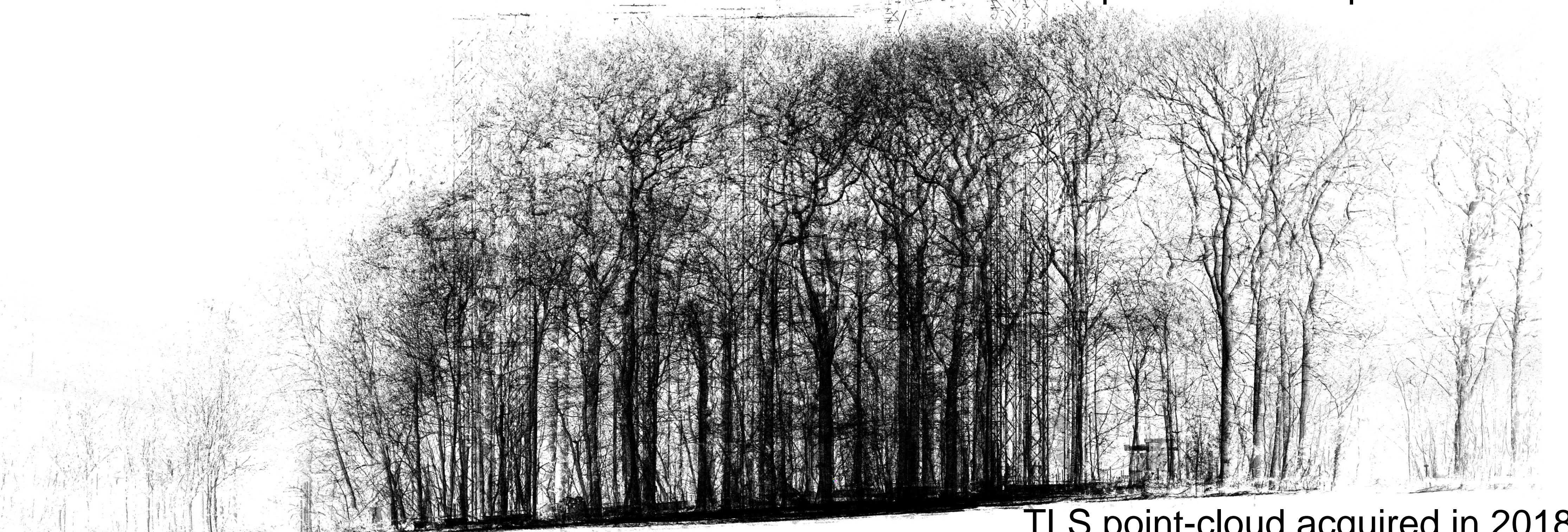
Example of a 5m³ tree before (Left) and after (Right) a surface reconstruction

[1] Rombourg R. *et al.* (2016) A point-cloud classification method to assess biases in tLiDAR-based forest canopy gap fraction estimates. *In: International Conference on FSPMA, Qingdao, China, November 2016*.
[2] Raumonen P. *et al.* (2013) Fast automatic precision tree models from terrestrial laser scanner data. *Remote Sensing* 5, 491–520.
[3] Åkerblom M. *et al.* (2015) Analysis of geometric primitives in quantitative structure models of tree stems. *Remote Sensing* 7, 4581-4603.
[4] Casella E. *et al.* (2013) tLiDAR methodologies can overcome limitations in estimating forest canopy LAI from conventional hemispherical photograph analyses. *In: 7th International Conference on FSPM, Saariselkä, Finland, June 2013*.

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