



# Using geometric UAV Data to derive bio-physical plant properties in Short Rotation Coppices

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## Introduction

The project focuses on implementing **machine learning** methods for the accurate estimation of bio-physical properties like tree trunk diameter in short rotation coppices (SRC). SRC are **fast growing woody species** and can be used for **energy production** (Oliveira et al., 2020). Estimating **biomass** by the height and diameter is possible (Shaiek et al., 2011) and could be improved by using remote sensing based on LiDAR data (Sun et al., 2022).

## Objectives

- Data collection at the Leibniz Institute for Agricultural Engineering and Bioeconomy agricultural site using LiDAR-equipped drones and GPS rovers for coordinate extraction
- Individual tree segmentation
- Inference of tree diameter at breast height

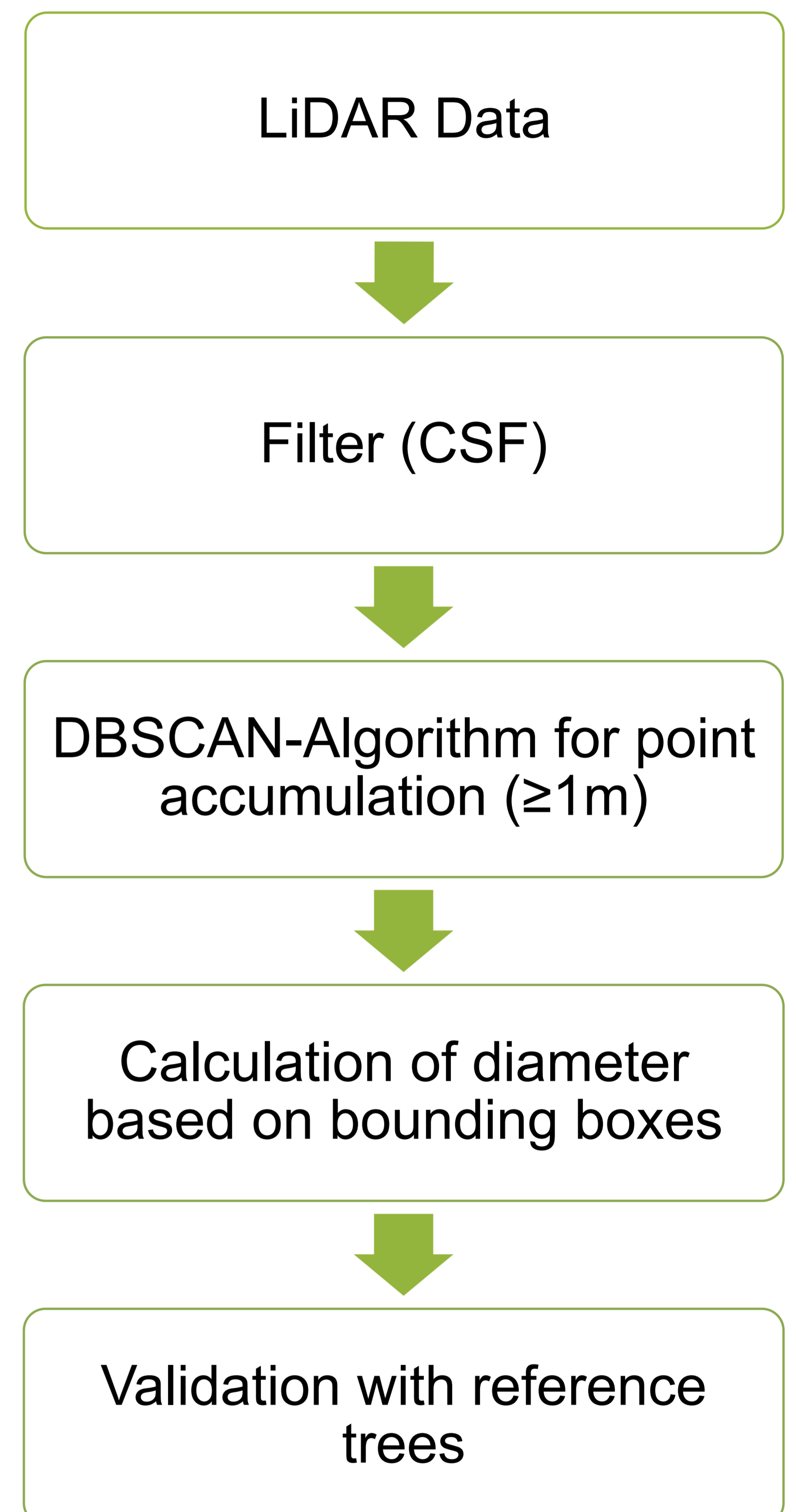


Fig. 4: Workflow

## Data Acquisition

- LiDAR Data (283 points/m<sup>2</sup>)
- Diameter at breast height and position of 57 trees



Fig. 1: UAV: DJI (M600), Scanner (RIEGL miniVUX-1UAV)



Fig. 2: RTK GNSS Receiver



Fig. 3: Poplars

## Results

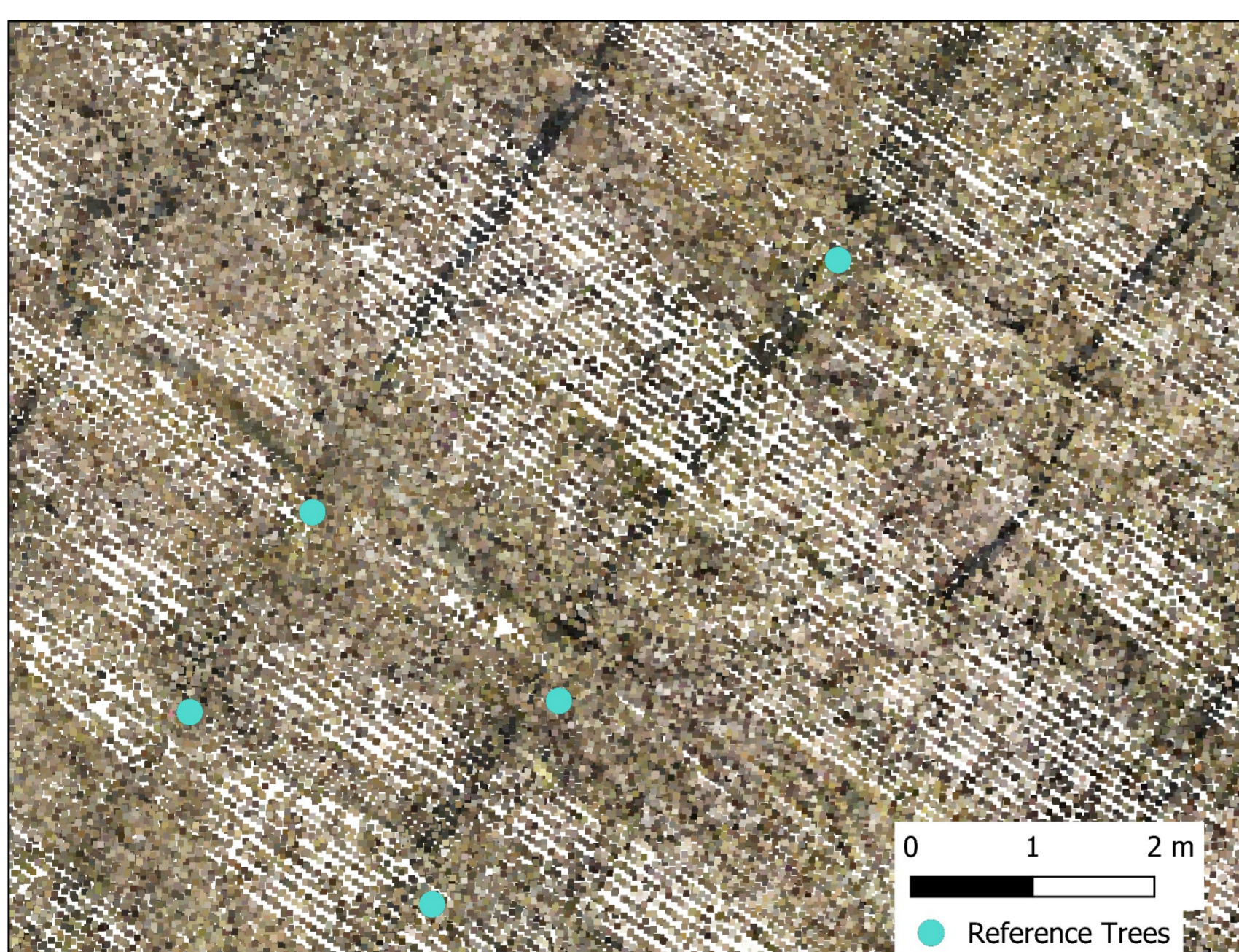


Fig. 5: Point Cloud with positions of the reference trees

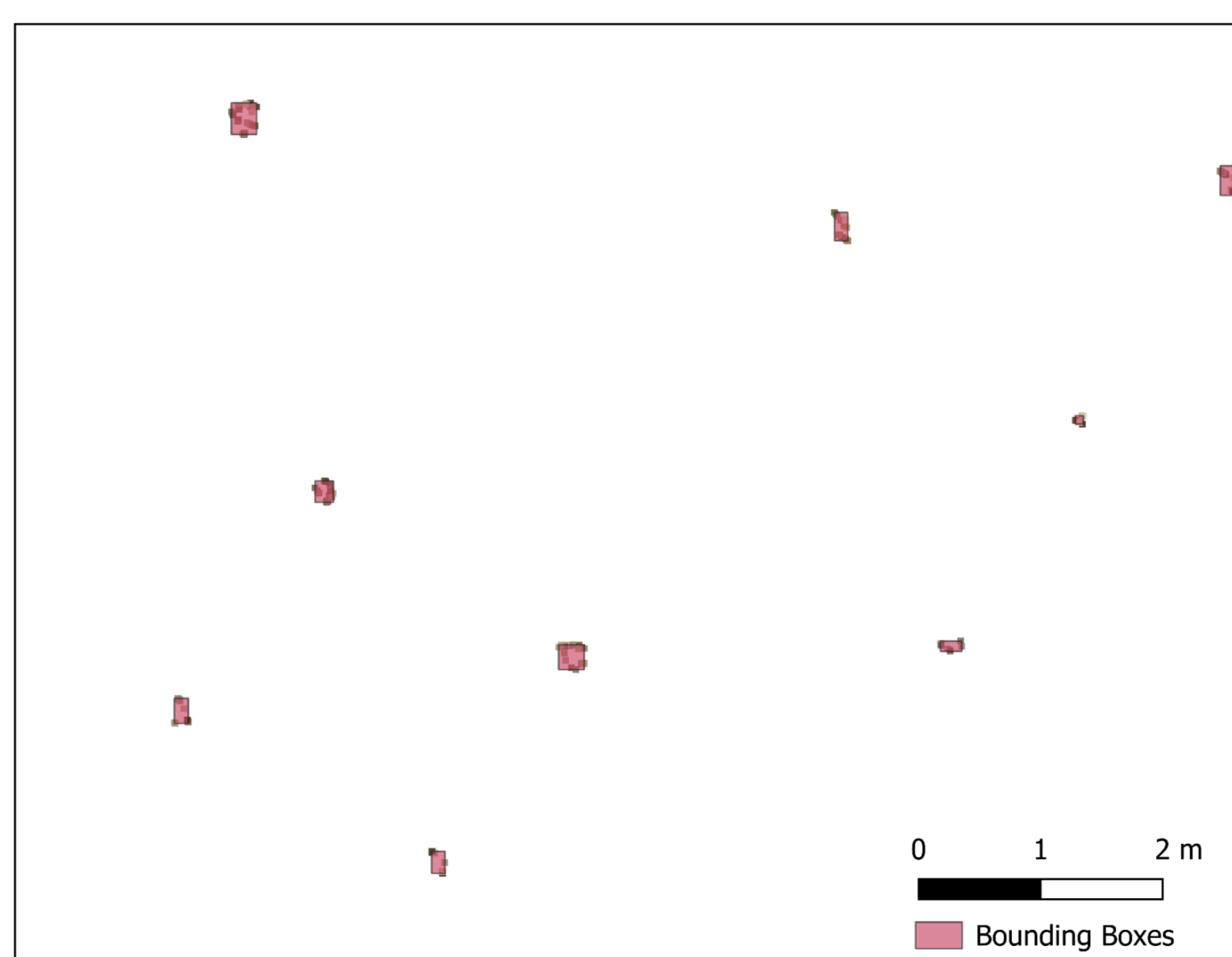


Fig. 6: Point Cloud after CSF-filter with Bounding Boxes of the DBSCAN-Algorithm

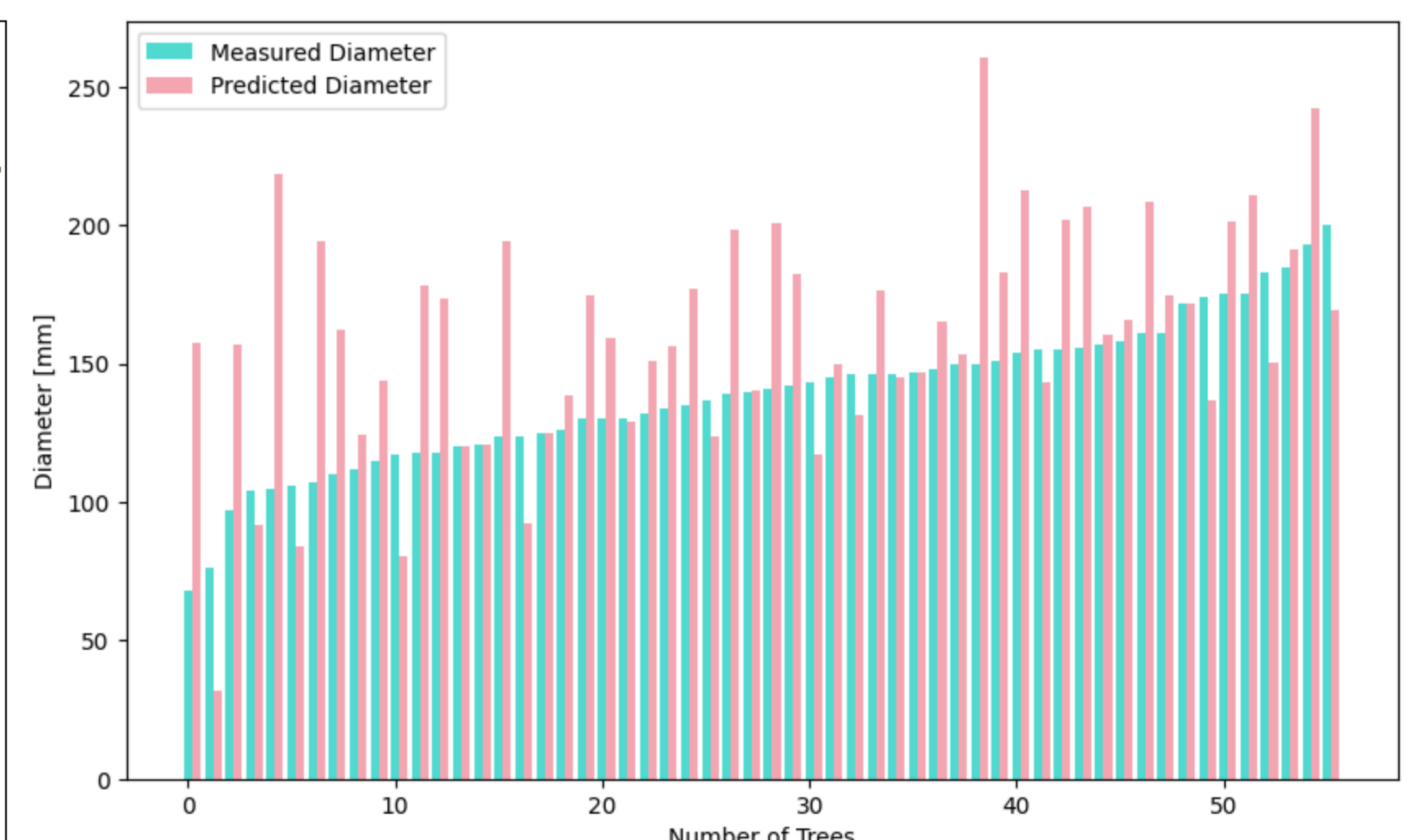


Fig. 7: Comparison of the measured and estimated diameters

## Conclusion and Future Work

- Tree trunks were successfully segmented.
- Initial diameter estimation results have shown promise, further exploration of different machine learning methods is proposed to increase the accuracy.
- Uneven trees are a potential issue, which could be solved by transitioning from 2D bounding boxes to 3D figures.

## References

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2. Oliveira, Perez-Cruzado, Canellas, Rodriguez-Soal, Sixto: "Poplar Short Rotation Coppice Plantations under Mediterranean Conditions: The Case of Spain," *Forests* 11, no. 12 (December 17, 2020): 1352, <https://doi.org/10.3390/f11121352>.
3. Shaiek, Loustau, Trichet, Meredieu, Bachtobji, Garchi, Aouni: "Generalized Biomass Equations for the Main Aboveground Biomass Components of Maritime Pine across Contrasting Environments," *Annals of Forest Science* 68, no. 3 (April 2011): 443, <https://doi.org/10.1007/s13595-011-0044-8>.

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