

MSc Topic – Terrestrial LiDAR for forest monitoring: Assessing the ecological value of standing tree stems on forest plots

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Introduction

To estimate the economic and ecological value of trees and/or stand is one of the core topics of the Swiss National Forest Inventory (NFI). Methods and models to evaluate the ecological value of a tree based on microhabitats (i.e. cavities, fungi, epiphytic structures and others) surveys have been developed by the Integrate+ program and are introduced in the 5th NFI. However, the assessing and measuring of microhabitats in the field is very time consuming and difficult to reproduce.

Terrestrial laser scanning (TLS) provides measurement techniques that can acquire data from surrounding objects with very a high level of detail. For forestry application, this data can provide detailed and reproducible information of tree stem surfaces. In this MSc, TLS and field data will be collected and the correlation between the ecological value of tree stems and the variations of its surfaces will be analyzed.

Details

Ecological value (EV) of tree stem	Apply different models to calculate the EV of a tree based on microhabitat surveys.
Geometric features from a tree stem point cloud	To assess the variations of tree stem surfaces, calculate geometric features of tree stem point clouds (for instance, based on the eigenvalues and eigenvectors of the local structure tensor).
Correlations between EVs of tree stems and geometric features from tree stem point clouds	Test the correlations between the EV of tree stems and geometric features from their point clouds. Evaluate which model of the EV of a tree has the strongest correlation with the geometric features from a tree stem point cloud.
Influence of spatial resolution of point clouds	Test the influence of the spatial resolution of a point cloud on correlations between the EV of a tree stem and its geometric features. Make recommendations regarding sufficient spatial resolution of TLS point clouds to assess EV of tree stems.

Opportunities offered by this MSc:

- Learn about ecological values of trees
- Practical handling of NFI field equipment and TLS scanning device
- Experimental design and acquisition of data in the forest
- Point cloud pre-processing and analysis
- R and C++ programming
- *Writing and publishing a scientific paper (as an optional follow-up)*