

***Remote Sensing Team:
LiDAR Still the Best Strategy for
Mapping Forest Canopy Openings***

Annette Dietmaier, MSc

University of Augsburg, Institute of Geography
annette.dietmaier@geo.uni-augsburg.de

Research Team:

¹Greg McDermid, ¹Mustafizur Rahman, ²Guillermo Castilla, ¹Julia Linke, ³Ralf Ludwig

¹ University of Calgary, Department of Geography;

² Canadian Forest Service, Natural Resources Canada;

³ Ludwig-Maximilians-Universität, Department of Geography



Project Summary

Forest canopy openings are a key element of forest structure, influencing a host of ecological dynamics. Light detection and ranging (LiDAR) is the de-facto standard for measuring three-dimensional forest structure, but digital aerial photogrammetry (DAP) has emerged as a viable and economical alternative. We compared the performance of LiDAR and DAP data for characterizing canopy openings across a 1-km² study area within BERA's "Kirby" site near Conklin, Alberta. LiDAR was found to delineate canopy openings best (87% overall accuracy), with the hybrid and DAP models both performing substantially lower (46% and 47% overall accuracy, respectively). The hybrid and DAP canopy maps did a good job with large openings but missed many small openings below 20m² in size. These small openings are an important element of boreal forest structure, and meant that DAP and hybrid datasets substantially under-reported the total area of openings across our site.

Management Implications and Lessons Learned

In general, DAP is a poor alternative to LiDAR for mapping the full range of canopy openings in the boreal forest, either with or without the enhancement of LiDAR-based DTMs. While large openings are well-mapped with photogrammetric data, we found small openings more difficult to detect and delineate. Our research illustrates DAP's sensitivity to occlusions, mismatched tie points, and other optical challenges that currently limit the technology's capacity to fully characterize 3-D canopy structure in forests. We recommend that operational use of DAP in forests be limited to mapping large canopy openings and area-based attributes that are well-documented in the literature.

Publication(s)

Dietmaier, Annette (2018): Comparison of airborne laser scanning and digital aerial photogrammetry for characterizing canopy openings in the boreal forest in Alberta, Canada. Master's thesis, LMU Munich Department for Geography.

Dietmaier, A., McDermid, G., Rahman, M. M., Linke, J., Ludwig, R. (2019): Comparison of LiDAR and digital aerial photogrammetry for characterizing canopy openings in the boreal forest of northern Alberta. *Remote Sensing* 11 (16), 1919.