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Title: Airborne laser scanning transects over Canada's northern forests: lidar plots for science and application
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MS type: Data description paper
Iteration: Minor revision

Thank you for the careful and detailed responses to the reviewers' comments. However, I believe that the following points still require further attention:

Thank you for the feedback. We address your concerns below.

1. Usage and usefulness of the provided datasets
The manuscript currently lacks concrete examples demonstrating the usage and applicability of the provided datasets. The authors indicate that the Background section includes examples of how similar datasets have been used for various applications. However, each dataset differs in terms of data acquisition methods, data quality and accuracy, and the methodologies used to derive metrics. As a result, examples based on other datasets do not sufficiently address the specific characteristics of the datasets presented in this study. I therefore consider it essential that the manuscript explicitly discusses the usage and limitations of the provided datasets, which remains insufficiently addressed.

The examples given in the Introduction and Discussion also relate to sampled ALS transects (i.e., "lidar plots"). The acquisition methods and specifications for those previous lidar transect acquisitions (Wulder et al. 2012a) are very similar to the dataset described in the manuscript. As a result, the examples given are highly relevant and leverage an analogous dataset. There is no shortage of use cases for these data by Canadian or international researchers. The areas under consideration here in northern Canada are well forested (see Figure 1) yet lack roads and access, making ground plot installation a costly endeavor. There is also limited motivation for wall-to-wall mapping using ALS data in these areas, as there are only sparse populations and limited commercial activity. This is a unique region that requires novel data collection initiatives, such as that afforded by sampled ALS. Using lidar-plots to aid with modeling of forest structure over these vast areas informs the development of comprehensive forest information products that would otherwise be unavailable.

We address the usage limitations in the discussion:

Despite the aforementioned strengths of lidar plots, several aspects of these data warrant further consideration. In particular, the ALS acquisitions are largely restricted to northern forests (Figure 1). Given the focused sampling to these northern forests, conditions present in the southern extent of Canada's forests will not be captured, as exemplified by the distributions of land cover classes within lidar plots (Figure 7), which differ markedly from the national summaries reported by Hermosilla et al. (2022). As these lidar transects were specifically designed to characterize northern forest conditions, they would need to be augmented with ALS data from southern forests to enable the development of national models of forest structure, as demonstrated in Matasci et al. (2018b). With more than 70% of Canada's managed forest area in the south having ALS data available (White et al., 2025), additional samples of ALS are readily available. Sampled transects also inhabit an unfamiliar form and scale for most users of ALS data. Within the lidar plots can be found detailed characterizations of both vegetation structure and terrain morphology (Figure 4, Figure 6). The data can also be analyzed at regional scales, by pooling lidar plots (Figure 5) to contribute to population estimates of attributes such as volume or biomass (Andersen et al., 2011; Margolis et al., 2015). However, by design transect data alone are not spatially exhaustive, precluding independent wall-to-wall mapping, and are intended to be incorporated with satellite and other ancillary data to support mapping via modelling methods such as imputation (Coops et al., 2021).

We have added an additional paragraph to the discussion on how the data will be used for applications:

These data will be used for a number of initiatives. Wildfire specialists will employ the data to contribute to the development of predictive models that estimate fuel attributes such as canopy species composition, crown base height, crown bulk density, forest floor cover type, and litter load (Boucher et al., 2023). National models of forest inventory attributes will be improved and brought up-to-date, including those related to height, structural complexity, biomass, and volume (Matasci et al., 2018b). The data will also inform carbon accounting by contributing to the development of pixel-based biomass yield curves (Tompalski et al., 2025).

2. Validation of point cloud classification
The validation of the point cloud classification is not described in a sufficiently clear or transparent manner. The authors refer to the Canadian lidar acquisition standard (CSA Group, 2025: Airborne lidar data acquisition, 83 pp.) as the basis for validation. However,

access to this document requires user account registration, which presents a barrier for readers seeking to understand and evaluate the data quality. Furthermore the number of sample plots used for validation is not provided.

As requested, we have added more detail to the description of the classification validation process, including the number of sample plots. We have updated the quality assurance section to read as follows:

> *The ALS vendors (Table 2) corrected GNSS coordinates using PPP, with all reporting sub-metre horizontal and vertical accuracies. Point cloud classifications were validated following guidance in section 8.6 of the Canadian lidar acquisition standards (CSA Group, 2025), which indicate that point classifications should be consistent across the entire project with minimal variations in the classification quality between tiles or swaths. For each acquisition year, twenty 1 km x 1 km point cloud tiles distributed across the acquisition areas (Figure 1) were selected for analysis. Within each tile, 20 randomly selected 400 m^2 areas were then clipped and three-dimensional visual checks of the point cloud classifications were performed using FUSION's pdq viewer (McGaughey, 2024). All point clouds were rasterized based on return class (Table 1) and hillshades were generated from the DTMs. Raster surfaces were then visually inspected to ensure specifications were met (e.g., all points were classified (unless withheld), water was properly classified, no areas with few or no ground returns, noise was classified correctly, DTMs were representative of the bare-Earth surface). Similarly, return counts and scan angles were rasterized to ensure transects fell within the specifications for point densities and swath widths (Table 1). All raster products were generated using LAStools (version 2.0.4). Any issues found were reported to the ALS data vendors who then made corrections.*

Relying on three-dimensional visual inspections alone does not provide a robust or quantitative assessment of classification accuracy. A more reliable approach would involve manually classifying all points within selected sample plots as ground truth and quantitatively comparing these results with the original point cloud classification.

We appreciate the reviewer's suggestion and agree that manually classifying points within sample plots can provide a quantitative means of comparison. However, we respectfully note that such an approach would not constitute true ground truth, but rather a second classification of the same data. This would result in a comparative analysis between our classification and that of the ALS providers, both of which may contain errors. In practice, ocular inspection of three-dimensional point clouds is an efficient and widely used method for identifying systematic misclassification errors,

which tend to be readily apparent (e.g., water classified as ground, bird strikes not flagged as high noise). Given the spatial extent and point density of this dataset, performing a full secondary manual classification is not feasible within the scope of this work.

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As we are about to receive data for the for 2025 acquisitions we can now add more detail to certain sections of the manuscript.

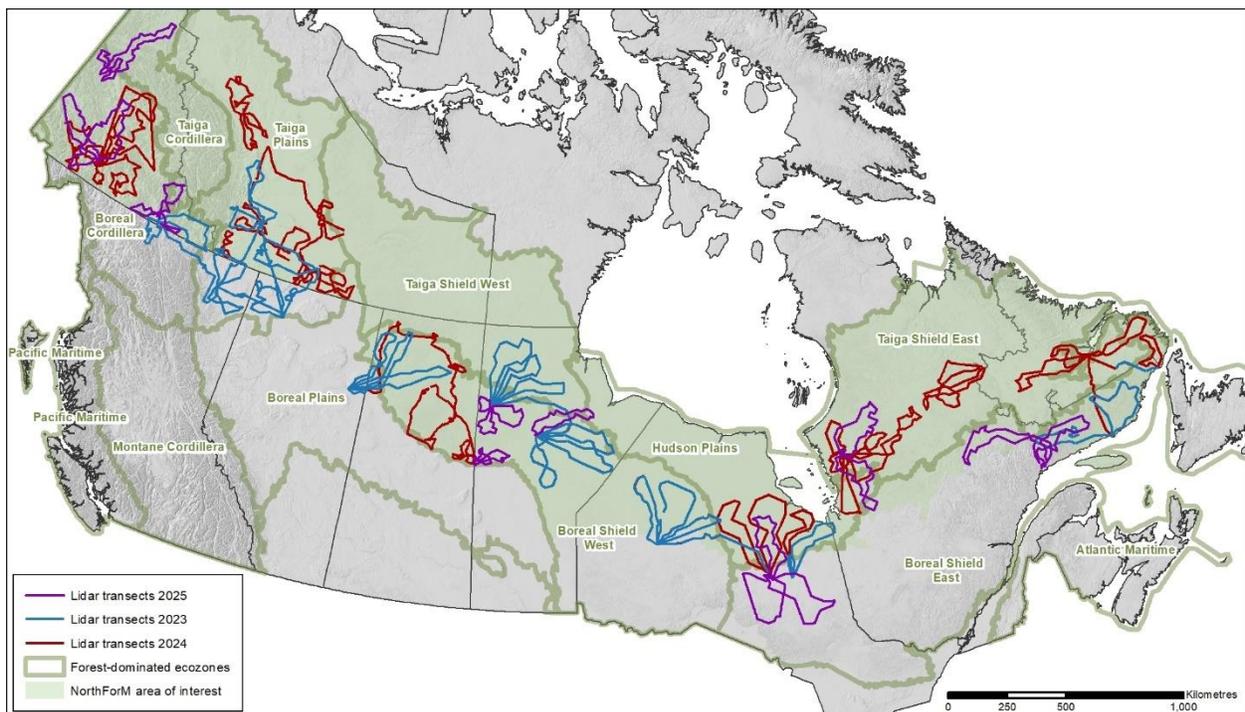Figure 1 has been updated to include 2025 transects (purple).

Figure 1. Airborne laser scanning (ALS) transects flown in 2023 (~20,000km), 2024 (~23,000 km), and 2025 (~12,000 km). The Northern Forest Mapping (NorthForM) acquisitions were largely focused on northern ecozones to improve mapping in unmanaged forests.

Table 2 has been updated to include additional sensor information for 2025

Table 2. Airborne lidar vendors for acquisition years 2023, 2024, and 2025. Each lidar plot (described in section 2.4) is linked to acquisition information in a relational database.

Acquisition year	Vendor	Lidar sensor
2023	Aeroquest Mapcon	Riegl VQ-1560II-S
	Eagle Mapping	Riegl VQ-780II-S & Riegl VQ-1560II-S
2024	Aeroquest Mapcon	Riegl VQ-1560 II-S
	Eagle Mapping	Riegl VQ-780II-S & Riegl VQ-1560II-S
	McElhanney	Leica TerrainMapper-2
2025	Aeroquest Mapcon	Riegl VQ-1560 II-S
	Kisik	Riegl VQ-1560 II -S

We have updated the results section to include more information on the 2025 acquisitions:

3 Results

3.1 ALS transects acquisitions

A total of ~20,000 km, ~23,000 km, and ~12,000 km of ALS transect data were acquired in 2023, 2024, and 2025, respectively (Figure 1). The 2023 acquisition focused on collecting data over forest-dominated ecozones that are currently lacking ALS coverage (White et al., 2025). The 2023 ALS acquisitions were significantly impacted by smoke caused by unprecedented wildfire activity in Canada (Jain et al., 2024), and as a result, 5,000 km of planned acquisitions were postponed for capture in 2024. The 2024 and 2025 transects focused on acquiring data over NorthForM ground plots (Boucher et al., 2023). In 2025, wildfire activity and inclement weather resulted in only 64% of planned data acquired. During the 2023, 2024, and 2025 field seasons over 900 ground plots were measured. Table 5 summarizes sampling intensity within NTEMS treed land cover classes for the 2023 acquisition (Hermosilla et al., 2022) by ecozone (Figure 1).