Assessing the capacity of UAV-based LiDAR to support Operationnal-level Forest Inventory

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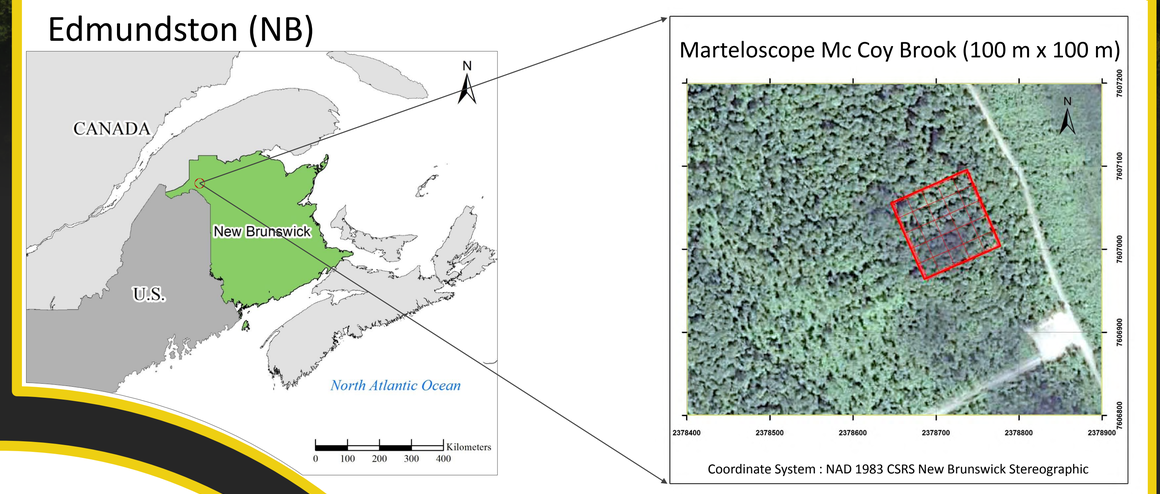
1. Context

Enhanced Forest Inventories derived from Airborne Laser Scanning (ALS) or stereo Image Point Clouds have been extensively used to produce **area-based estimates** of growing stock (basal area, volume) and average tree size (diameter, height, volume) on large area.

There is a growing interest in adding information on **wood attributes** at the **tree level** for supporting **Operational-level Forest Inventory** (OFI). **UAV-based lidar** (ULS) has the ability to provide high density data on a finer scale with great operational flexibility with a high spatial / temporal resolution and can potentially support OFI.

3. Study site



2. Objectives

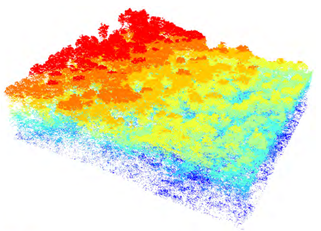
(A) Estimate **diameter distribution** of trees by direct and indirect methods using the lidar point cloud;

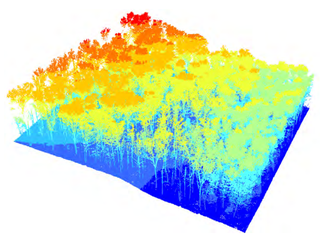
(B) Identify and estimate a core set of **ULS metrics** that can support OFI conducive to different forest ecosystems :

- Northern Hardwoods forest (NB, Canada)
- Coniferous boreal forest (NL, Canada)
- Evergreen tropical forest (Congo)

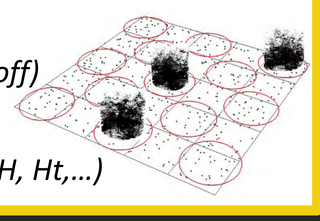
4. Material

- ULS Riegl-Vux *(leaf-on)*

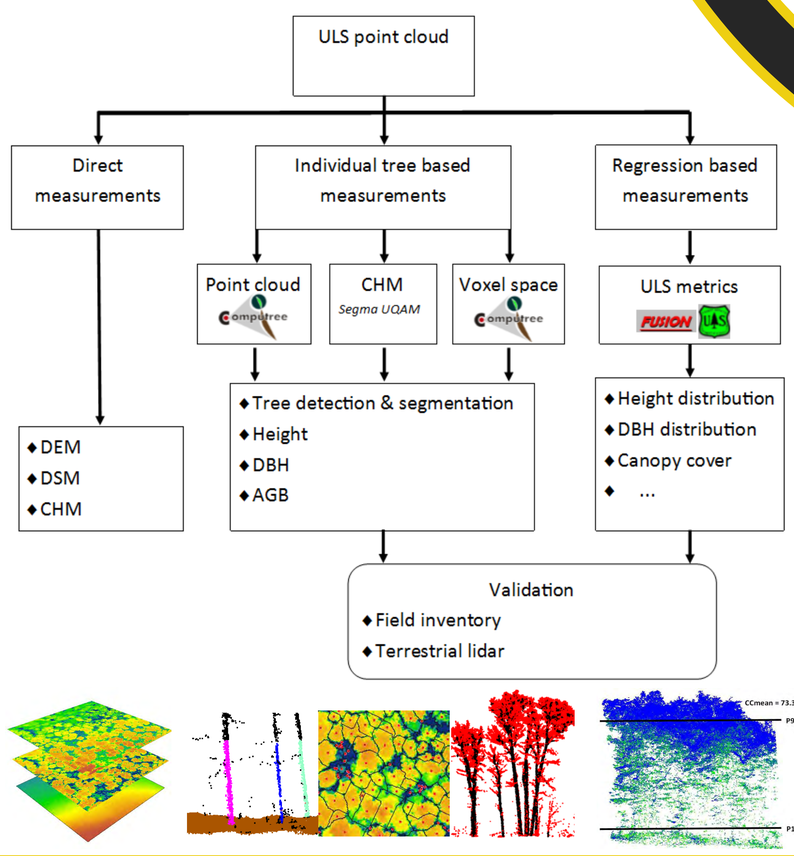




- ULS Velodyne *(leaf-off)*
- Terrestrial lidar *(13 plots leaf-on & off)*
- Field inventory *(Treemap (RTK), DBH, Ht,…)*

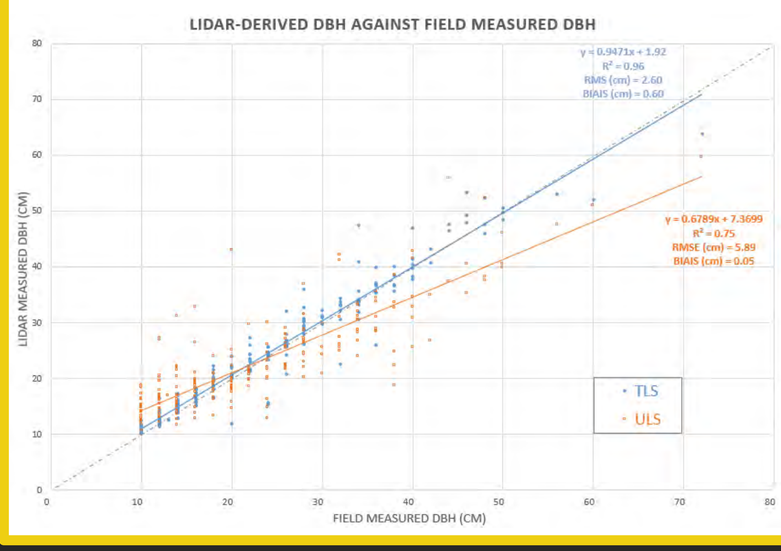


5. Method



6. Preliminary results

DBH extraction on ULS Velodyne data *(leaf-off)*



Cylinder fitting and DBH extraction on ULS Velodyne

7. Next steps

- **Improve the process** to estimate diameter distribution from ULS;
- Extract and identify the **most relevant ULS metrics** for supporting OFI and investigate the added value of ULS metrics compared to ALS;
- **Adapt the methodology** to investigate the potential of ULS data in boreal coniferous and evergreen tropical forest for the extraction of forest structural attributes.

8. References

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- Lin, Y., Hyyppä, J., Jaakkola, A. (2011) Mini-UAV-Borne LIDAR for Fine-Scale Mapping. *IEEE Geoscience and Remote Sensing Letters* 8: 426–430.
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Acknowledgments

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