Boreal Ecosystem Recovery & Assessment
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REMOTE SENSING TEAM 2018: *COMPARISON OF PHOTOGRAMMETRY AND LIDAR FOR FOREST CANOPY GAP DETECTION*

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Project summary

Governmental ecological protection plans require reliable environmental monitoring over large areas. One parameter of interest is the canopy gap fraction of a given forest, or the amount of openings in the canopy cover. Canopy gaps influence rejuvenation and biodiversity, but can also have detrimental effects on the composition of a forest ecosystem. Field campaigns are one way to measure and monitor gaps, but they are costly, spatially restricted, and prone to human error. Alternatively, gap detection based on remote sensing can serve as a more accurate and reliable way to fulfill monitoring needs. My research has 3 goals: 1) to determine the capacity of two types of 3-D remote sensing – light detection and ranging (LiDAR) and digital airborne photogrammetry (DAP) to characterize canopy gaps in the boreal forest; 2) to develop a workflow that can map canopy gaps accurately and efficiently over large areas; and 3) to determine the ecological implications of detected gaps. I documented overall accuracies for LiDAR between 90% and 93%, DAP and Hybrid were between 63% and 82%. LiDAR can accurately delineate even very small gaps (< 4 m2), whereas DAP shows significant errors of omission (> 90%) in gaps less than 200 m2 in size. The Hybrid model, which combines LiDAR and DAP, performed slightly better than the DAP model alone.

Progress to date

I began work on this project in April 2018. I spent two weeks in the field near Conklin this past summer, gathering a total of 1835 ground control points for use in calibration and validation. I finished the quantitative analysis this fall, and am just finishing up my thesis. I expect to complete my Masters program by Christmas, 2018. A journal manuscript is in preparation.

Management implications

Both LiDAR and DAP can map canopy gaps quickly and efficiently over large areas, but it is not clear which data source is best-suited to the task. DAP is more accessible and affordable than LiDAR and provides an attractive alternative. However, my results show that DAP on its own is not a viable equivalent to LiDAR in terms of accuracy and reliability.

Geographic location

The study area for this research is the Kirby South site located near Conklin, Alberta.