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| **Continuous Forest Inventory ‘fueling’ the adaptation of silviculture to new realities in Canada** |
| **Introduction/Aim:** Canadian forests are facing unprecedented levels of natural disturbances. In the year 2023 alone, over 18 million hectares of forests were affected by wildfires across the country. With insect epidemics, diseases, windthrow and acute climatic events also affecting forest dynamics, Canadian silviculture is facing unprecedented uncertainty. The tools that silviculturists use are insufficient to fully inform the future growth and survival of forest stands. To provide practical solutions for silviculturists and facilitate the adaptation of their practices to new realities, industry, government and academic partners across Canada have joined forces in the NSERC Alliance Silva21 project. As part of this project, a novel continuous forest inventory framework was developed and applied across multiple forest management units, and is now ‘fueling’ the adaptation of silvicutlure to climate change. **Methods:** The framework encompasses indispensable elements for updating forest inventories, encompassing change detection and growth monitoring. Within this framework, we extend upon established applications of airborne laser scanning ALS-derived enhanced inventories, amalgamating them with data from constellations of satellites offering freely available and preprocessed moderate spatial resolution imagery for analysis. Our methodology involves fitting trajectories to sequences of pixel-level spectral index values to identify alterations. Upon detection of stand-replacing changes, pertinent values of inventory attributes at the cell level undergo recalibration and restoration in accordance with an assigned growth trajectory. Conversely, for non-stand-replacing disturbances, estimations at the cell level are adjusted based on predictive models established to correlate the observed spectral changes with relative alterations in inventory attributes. **Results:** Applications of the framework have been conducted at the Romeo Malette Forest in Ontario, Quesnel Forest in British Columbia and in Lac-St-Jean, Quebec. Results have shown that detection algorithms are efficient in the characterisation of areas affected by stand-replacing disturbances, which can help plan salvaging operations. Monitoring the variation of spectral indices over time showed that it was possible to detect non-stand replacing disturbances and quantify their impact on stand basal area. By matching spectral indices data with ring width data from dendrochronological measurements, it was possible to predict the occurrence (79.2% accuracy) and quantify the severity (R2 = 0.70) across the landscape of a basal area growth decline observed in black spruce (*Picea mariana*) over the last decade. Such a model could be used as an early warning signal of fine-scale changes such as those due to insect defoliation or drought, and for targeted prescriptions of remedial actions such as thinning, or timely final harvest in the case of a severely declining stand. Using structural information form Aerial Laser Scanning (ALS) data, we were also able to show that the variability in growth trend across the landscape was related to forest development stage, species composition, and stand structural attributes, suggesting that these attributes could be manipulated through silviculture to produce stands that are more resistant and resilient to stressors.**Conclusion:**The near real-time information provided to silviculturists by this continuous inventory framework is providing key information that is leading the transformation of silviculture from an empirical to a more mechanistic discipline. |