Title: A systems analysis of Canada's Boreal forest: the role of improved growing stock

Names of collaborators: Kyle Lochhead, Dr. Valerie LeMay (co-supervisor), Dr. Gary Bull (co-supervisor), Dr. Saeed Ghafgazi, Dr. Steven Northway, and Dr. Olaf Schwab

Project Description: Over the past decade Canada has emerged as an international leader in forest genomics as a result of significant public investment. This research has developed innovative tools that help tree breeding programs select for high quality, fast growing, disease and pest resistant traits. However, it is uncertain how investing in this superior planting material within Canada's Boreal forests can provide a means to gain economic resiliency under uncertain environmental and economic conditions.

A systems analysis is one approach for assessing the impacts of these forest regeneration strategies and requires a spatial inventory of forest attribute information. To support this need, we define relationships between remote sensing and other auxiliary data to multiple attributes of forest structure are as they provide the ability to forecast the system and project the inventory through time. As a component of this research we are comparing spatial and non-spatial imputation methods as approaches to define these multivariate linkages for use in multi-sourced forest inventories.

In the case of the boreal forest in Canada, a multi-sourced forest inventory needs to extend over 223 million hectares in order to assess various uncertainties in large-scale, long term forest landscape planning models. To accomplish goal this we are working with Canada's National Forest Inventory (NFI,< https://nfi.nfis.org/index.php>), satellite imagery, and other freely available spatial information; and to project the inventory through time we are working with provincial empirical growth and yield simulators and newly designed Java based supply chain simulation and optimization software called AROMA (<https://www.youtube.com/watch?v=iEuxr352u8A>).

The following objectives of the study are:

1) To compare alternative spatial and non-spatial imputation methods for mapping forest structure attributes of the Canadian Boreal forest;
2) To map the decision space for implementing improved growing stock across large scales under varying levels of investment and uncertain fibre sources;
3) To assess the economic impacts of implementing improved growing stock across large-scales on the long term competitiveness of the Boreal forest sector