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Climate Change Impacts on Maple Syrup Yield in Nova Scotia



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Executive Summary

Average maple syrup yield/tap, while fluctuating, has constantly been declining, which is one of major concerns to maple syrup producers in Nova Scotia. Global warming and/or climate change is suspected to contribute to this decline in the syrup yield/tap. Nevertheless, no specific studies were conducted in Nova Scotia to ascertain this hypothesis. Moreover, the industry faces the challenge of identifying the optimal start date of the sap flow that would allow maximum sap yields and consequently high economic returns. Sap flow is a consequence of the interactions between the tree's physiology, environment and weather; and our knowledge on the influence of weather on maple syrup in Nova Scotia is very limited. Owing to this gap, no indicators are currently available to scientifically assist in projecting tap date or harvest decision processes. In order to address these issues, this project was initiated to: (i) assess the climate change scenario in Nova Scotia, (ii) understand the link(s), if any between the climatic factors and (iii) model the relationships, if any, to predict syrup yield and sap flow dates. Historical weather data from various weather stations was collected from Environment Canada and the Maple syrup production data was collected from growers across Nova Scotia. Changes in the weather parameters for mean temperature and effective growing degree days (EGDD) were assessed against the average maple syrup records from 1978-2013. We found that mean annual temperature has increased by 1°C in the last 15 years. This increase has translated into an increased an average EGDD of 125 days. The implications on the maple tree growth were multi-faceted and negative in relation to syrup yield. When historical (1970-2013) syrup yields and EGDD were regressed, it was evident that the decline in syrup yields (0.65 to 0.33 L/tap/yr) coincided with the increase in the EGDD (~125 days) in Nova Scotia. Simultaneously, during this period, the start date for the sap flow has started earlier by approximately 5 days. These trends indicate a negative effect of climate change on the NS maple syrup production. However, the length of tapping season remains unchanged. Over 108 weather parameters were screened for their relationship with syrup yields, only six of the weather parameters strongly correlated with syrup yields and three weather parameters correlated with the start date of the sap flow. With these input parameters a neural network-based syrup yield model was constructed to predict syrup yields and start date of sap flow. The performance of the model varied from good fit to poor fit depending on the locations. The syrup yield model showed strong potential to predict the syrup yields and start date. However, its ability is limited owing to the small size of training data and lack of calibration data from multiple locations.

