

Using Machine Learning Techniques to Help Predict Maple Sugaring Potentials in Northern US

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Maple syrup is produced from the sap of maple trees (*Acer*) and is a staple in Canada and the northern US, where maple trees thrive. The US practice of making maple syrup began with New England colonists who, facing expensive sugar imports and suspended agriculture, turned to maple sap for sweeteners. This led to maple syrup's popularity, resulting in increased production and innovation in production methods. The natural process of maple sap formation is complex and heavily affected by biological and environmental factors, resulting in significant fluctuations in sap yield over time. This study employs machine learning to understand drivers of the basal area of maple trees, a crucial indicator of maple sugaring potentials. Data was collected from 2000 to 2022 from the Forest Inventory and Analysis Database. A random forest (RF) model was employed for the analysis while a multiple linear regression model (MLR) was used for baseline comparison. We found that RF significantly outperformed MLR in terms of Root Mean Square Error. Forest density, evapotranspiration, and the number of sugar maple trees are among some primary predictors of the basal area of maple trees.