

## Maple Monitoring in New York's North Country

Nature Up North is a community-based organization, whose mission is to foster a deeper sense of appreciation for, and connection to, the North Country environment. They have many citizen science projects that engage community volunteer scientists to help collect data that is meaningful for local and global communities. Citizen science encourages students and community members to spend time outside and get involved with our local community, contributing to research by expanding the understanding of local and global issues such as climate change, invasive species, and more. As part of these projects they receive a wealth of data that we are not capable of going out and collecting on our own. More information about the organization can be found online at: <http://natureupnorth.org/>.

Nature Up North's flagship citizen science project is Monitor My Maple, which focuses on sugar maple trees (*acer saccharum*). Iconic North Country trees with considerable economic importance in their region, sugar maples are predicted to suffer from the impacts of climate change. Since 2013 North Country residents of all ages have observed the phenology, or timing of seasonal changes, in their local maple trees by collecting data on all types of maple trees during the fall and spring seasons. Understanding this data could ultimately lead to an understanding of the changes in the maple tree population.

For this assignment you will work in groups (up to four people of your choosing) to explore and make sense of the gathered data. The data were collected over the last 5 years in the fall and spring seasons, among thousands of cases of maple trees over more than a dozen variables. As the data were gathered by volunteers of all ages, and is a large, complex, and messy data set, the data may not be in an optimal format for analysis. The data that you have to use has been cleaned and reformatted to some extent, but may require more finessing before it can be analyzed. Two datasets (for fall and spring seasons) can be found on Sakai.

### Section 1: ANOVA Analysis

Use the techniques discussed in class to analyze some aspect of the data using one-way, two-way, and two-way with an interaction ANOVA models. Discuss if the analyzed data meets the conditions for the ANOVA models and analyze the residuals. Also discuss the results of your analysis in the context of the data. Does it make sense to do this analysis given the context?

### Section 2: Logistic Regression

Use the techniques discussed in class to construct a logistic regression model to predict one of the variables. You may want to construct new variables from the given data to force new binary categories. Use `bestglm` (or any model selection method) to find the best model for predicting your binary variable. Discuss the results of your analysis in the context of the data. Does it make sense to do this analysis given the context?

### Section 3: Multiple Linear Regression

Use the techniques discussed in class to construct a multiple linear regression model to predict one of the variables (there are not many options for the response variable). Use a model selection method to find the best model for predicting your response variable. Discuss if the

analyzed data meets the conditions for the multiple linear regression model and analyze the residuals. Also discuss the results of your analysis in the context of the data. Does it make sense to do this analysis given the context?

#### **Section 4: Further Analysis**

Use techniques that were *not* discussed in class to analyze the data further. This may be done through the use of a package not used in class (such as ggplot2). Briefly describe how you have used the package to analyze the data. Discuss the results of your analysis in the context of the data. Does it make sense to do this analysis given the context?