

A Dendrochronological Analysis of Canadian Prairie Shelterbelts: Sutherland Farm I



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Abstract

As a part of the Agricultural Greenhouse Gases Program, which seeks to determine the carbon sequestration capabilities of shelterbelt trees and their response to climate and climate change, the Mistik Askiwin Dendrochronology Lab conducted a tree-ring analysis on shelterbelt trees throughout Saskatchewan. Using dendrochronological cross-dating techniques and climate analysis, radial growth chronologies were established, and the relationship between tree growth and climate was assessed. At Sutherland Farm, green ash (*Fraxinus pennsylvanica*) samples were collected from 20 trees. The oldest tree sampled was 91-years old and the overall average age of sampled trees was 70 years. The strongest climatic variables exerting a positive effect on green ash radial growth at this site was June and then July precipitation in the current growth year.

Introduction

The Mistik Askiwin Dendrochronology Lab (MAD Lab) located at the University of Saskatchewan, is currently involved in a project for the Agricultural Greenhouse Gases Program (AGGP), which is investigating the capability of shelterbelt trees to store carbon. The carbon storage capability of these trees will inform their ability to offset carbon emissions and potentially act as carbon credits. The objective of the larger project is to determine the current and future capacity of carbon sequestration in these shelterbelt trees.

In the summer of 2014, samples for this project were collected across most of Saskatchewan. These samples were used as a part of the larger study, looking at shelterbelt tree growth over time since the trees were planted. As a landowner, and therefore a stakeholder in this project, we would like to provide you with the results from our findings on your property.

Site Information

MAD Lab Site Code: 14MLM00

Date: July 17th, 2014

Site Name: Sutherland Farm

Site Contact Info: Brian Robert Sutherland

Latitude: 52° 08' 38.04"

Longitude: -106° 49' 12.68"

UTM: 5778696 0375465

UTM Zone: 13U

MASL (m above sea level): 515m

Satellites: 11

Precision: ± 3m

Species Common Name: Green Ash

MAD Lab Species Code: M00

Methods

The MAD Lab sampled 20 green ash trees (*Fraxinus pennsylvanica*), using a 5.1 mm increment borer to take two core samples from each tree at approximately breast height. These samples were stored in plastic straws and taken back to the MAD Lab in Saskatoon, Saskatchewan for analysis. The samples were glued into slotted mounting boards and labeled with the appropriate site code. The samples were sanded with progressively finer sandpaper (60 to 600 grit) and then buffed in order to reveal the cell structure of the tree rings. The annual-growth rings were measured under a microscope using a Velmex stage system with a precision of 0.001 mm. The measurements from each core create a growth pattern, which could then be matched against that from the other cores taken from that site. The combination of all radial growth records extracted from cores taken from a single site allows for the creation of a site-specific master growth chronology representing the overall average tree growth through time. The master chronology was then standardized to remove age related and biological growth trends, providing a cleaner signal.

The resulting standardized growth chronology was then used to determine the environmental factors influencing the tree's growth. Annual tree-ring measurements were compared to historical climate data from the Saskatoon weather station, using the program DendroClim. The program provides statistical correlations, which allow us to identify which climate variables most significantly influence the growth of the trees at each site.

Results and Discussion

The oldest tree was found to be 91-years old at breast height, while the average age of all trees at the site was 70. The average raw ring-width measurement was determined to be 1.35 mm (see Figure 1 for the standardized growth of the tree over time). The climate data from the Saskatoon station indicated that June and July precipitation from the current growing season (year = n) positively affected tree growth at the site. July temperature from the previous growing season (year = n-1) negatively affected tree growth at the site (see Figures 2 and 3).

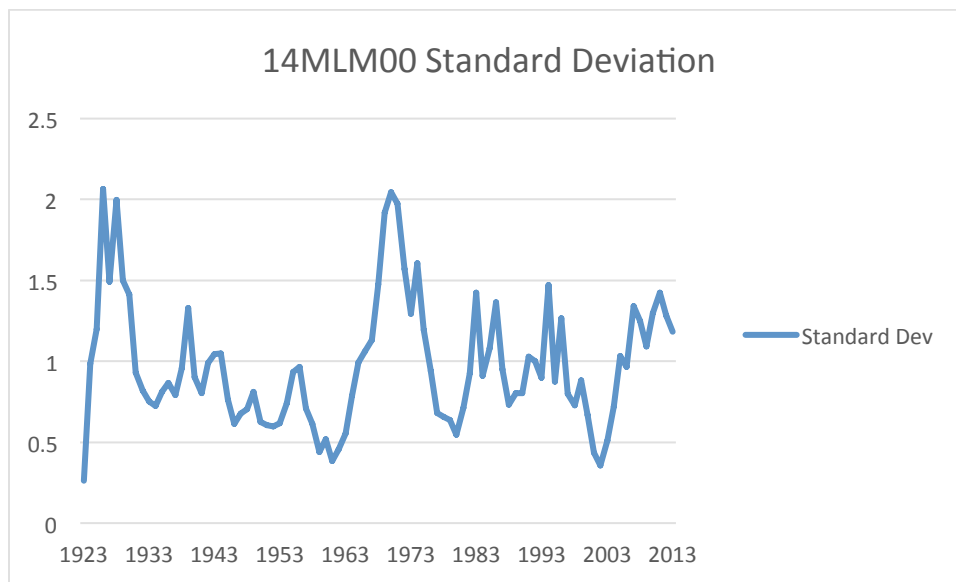


Figure 1: Master chronology for green ash at the Sutherland Farm site. Standardized measurements of 1.00 indicate an average year of growth (in this case, associated with a raw ring-width of 1.35 mm), while any value above or below 1.00 indicate a year of growth that deviates from the average.

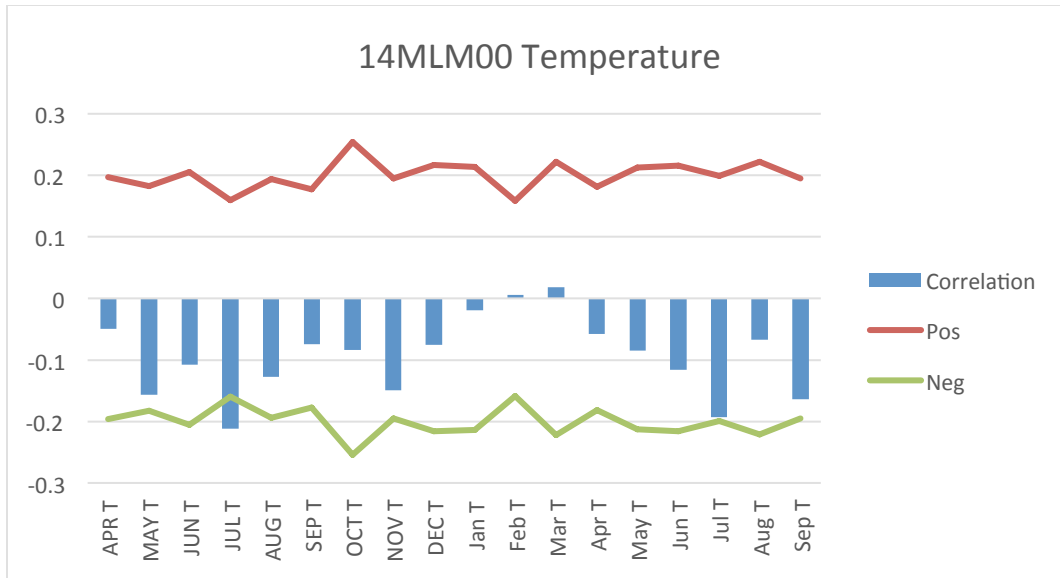


Figure 2: Results of the climate analysis comparing annual tree-ring growth to historical temperature variables from Saskatoon, SK. The bars represent the degrees of correlation between the tree growth and the climate variable. The places where the bars cross the linear threshold are considered significantly correlated. The uppercase letters (ie. APR) label the previous years' variables.

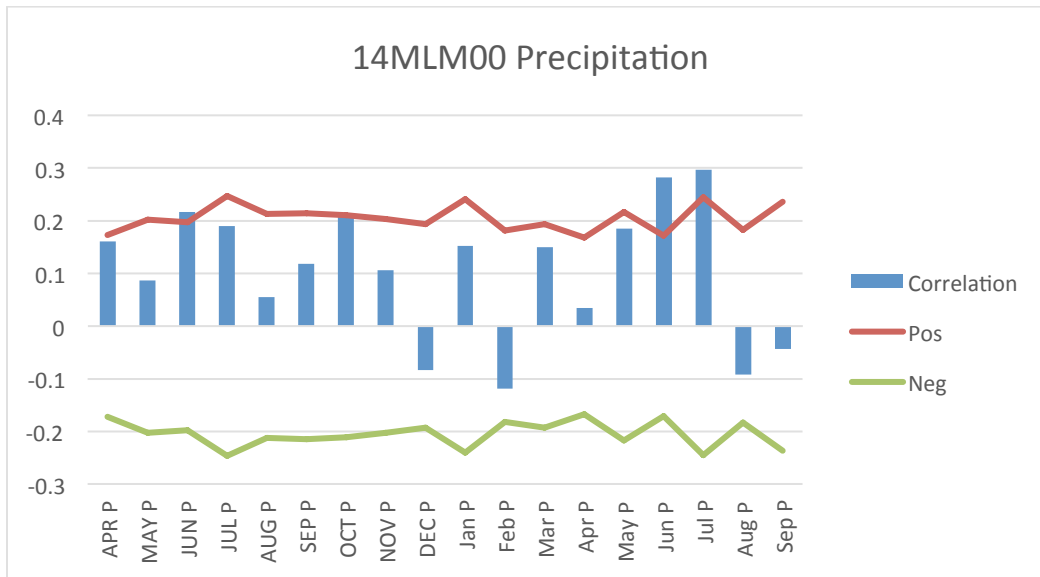


Figure 3: Results of the climate analysis comparing annual tree-ring growth to historical precipitation variables from Saskatoon, SK.

Conclusion

The results of this analysis help to strengthen our record of green ash growth over time within Saskatchewan's northwest. They also provide us with an understanding of the important climate variables driving tree growth in northwestern Saskatchewan, in this case June and July precipitation. The data collected from this site will be used in future studies, which will attempt to determine future growth trends and the amount of carbon sequestered by green ash to determine its potential and viability for ongoing carbon sequestration.

This research was conducted at the MAD Lab in Saskatoon, Saskatchewan, and funded through the AGGP. Any questions regarding the findings of this report should be directed to:

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