

A Dendrochronological Analysis of Canadian Prairie Shelterbelts: Grad Farm.



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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 the Grad Farm, hybrid poplar (*Populus sp.*) samples were collected from 20 trees. The oldest tree sampled was 41-years old and the overall average age of sampled trees was 33 years. The climatic variables exerting a negative affect on hybrid poplar radial growth at this site include March, April and May temperature from the current growing season (year = n), and May and June temperature from the past growing season (year = n-1). There was no significant relationship between precipitation and tree growth in this case. However the temperature relationships signify an overall moisture deficit in spring for radial growth later in the 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: 14QLN00

Date: July 21th, 2014

Site Name: Grad Farm

Site Contact Info: Lila Grad

Latitude: 50° 28' 46.8" N

Longitude: 104° 12' 15.0" W

UTM: 0556466 5592268

UTM Zone: 13U

MASL (m above sea level): 690m

Satellites: 11

Precision: ± 4m

Species Common Name: Hybrid Poplar

MAD Lab Species Code: N00

Methods

The MAD Lab sampled 20 hybrid poplar trees, 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 Regina climate 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 41-years old at breast height, while the average age of all trees at the site was 33. The average raw ring-width measurement was determined to be 4.24 mm (see Figure 1 for the standardized growth of the tree over time). The climate data from the Regina station indicated that there was no significant relationship between precipitation and tree growth in this case, but there is a negative relationship to spring temperature (see Figures 2 and 3).

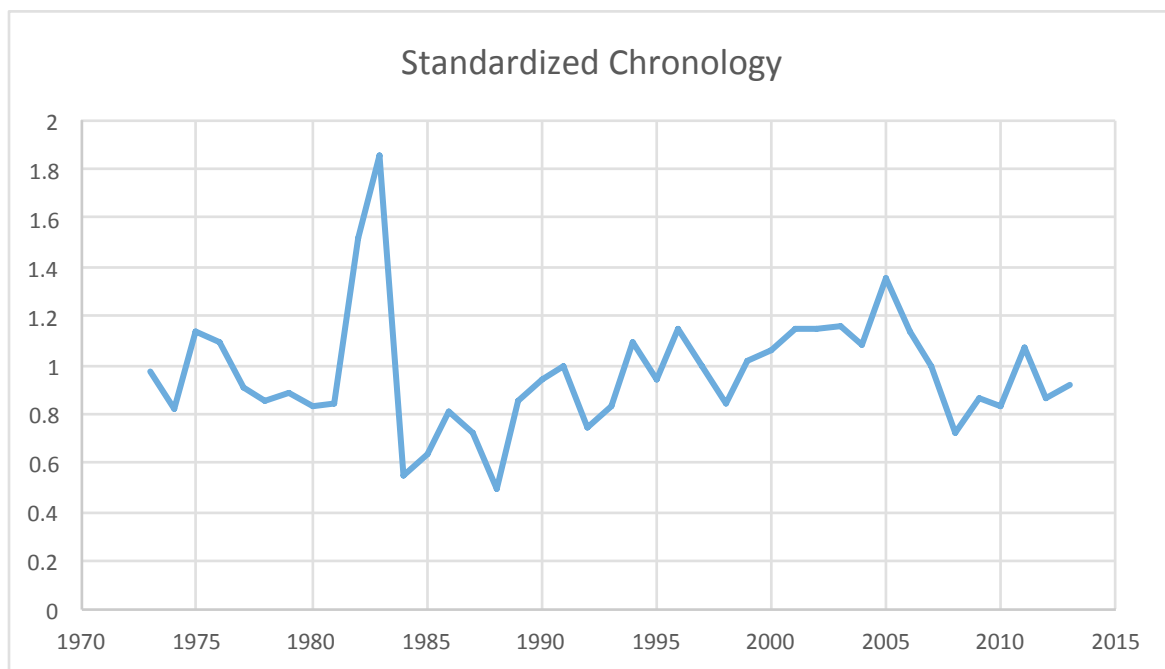


Figure 1: Master chronology for hybrid poplar at the Grad Farm site. Standardized measurements of 1.00 indicate an average year of growth (in this case, associated with a raw ring-width of 4.24 mm), while any value above or below 1.00 indicate a year of growth that deviates from the average.

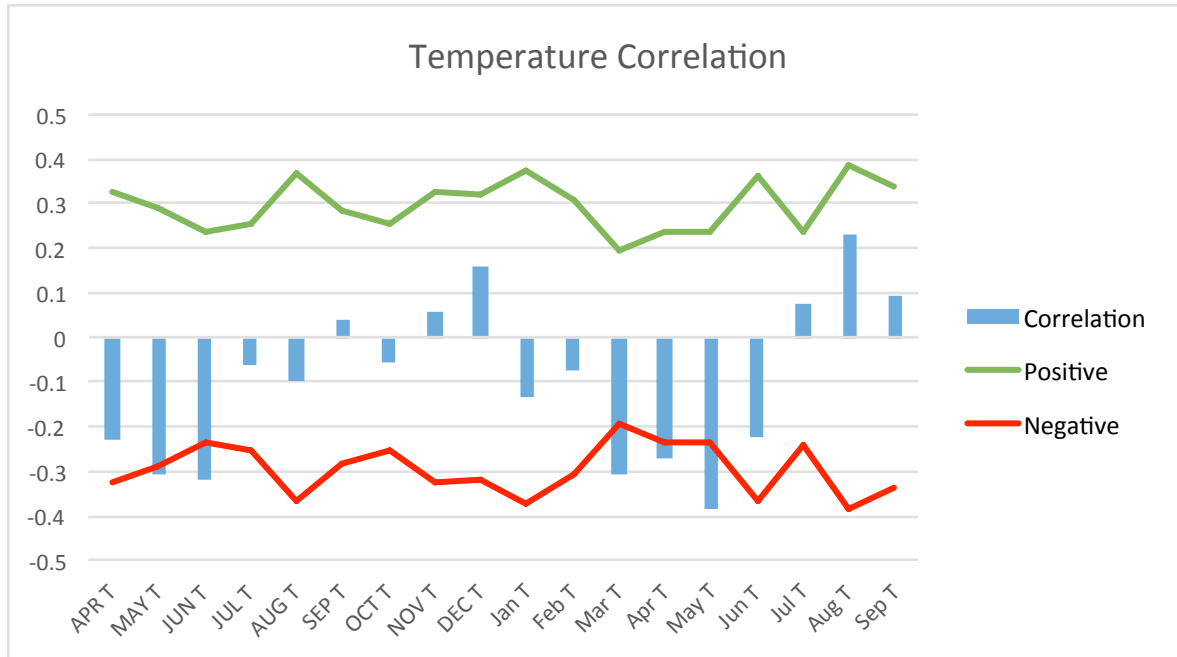


Figure 2: Results of the climate analysis comparing annual tree-ring growth to historical temperature variables from Regina, SK. The bars represent the degrees of correlation between the tree growth and the climate variable. The places where the bars cross the linear threshold are considered significantly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

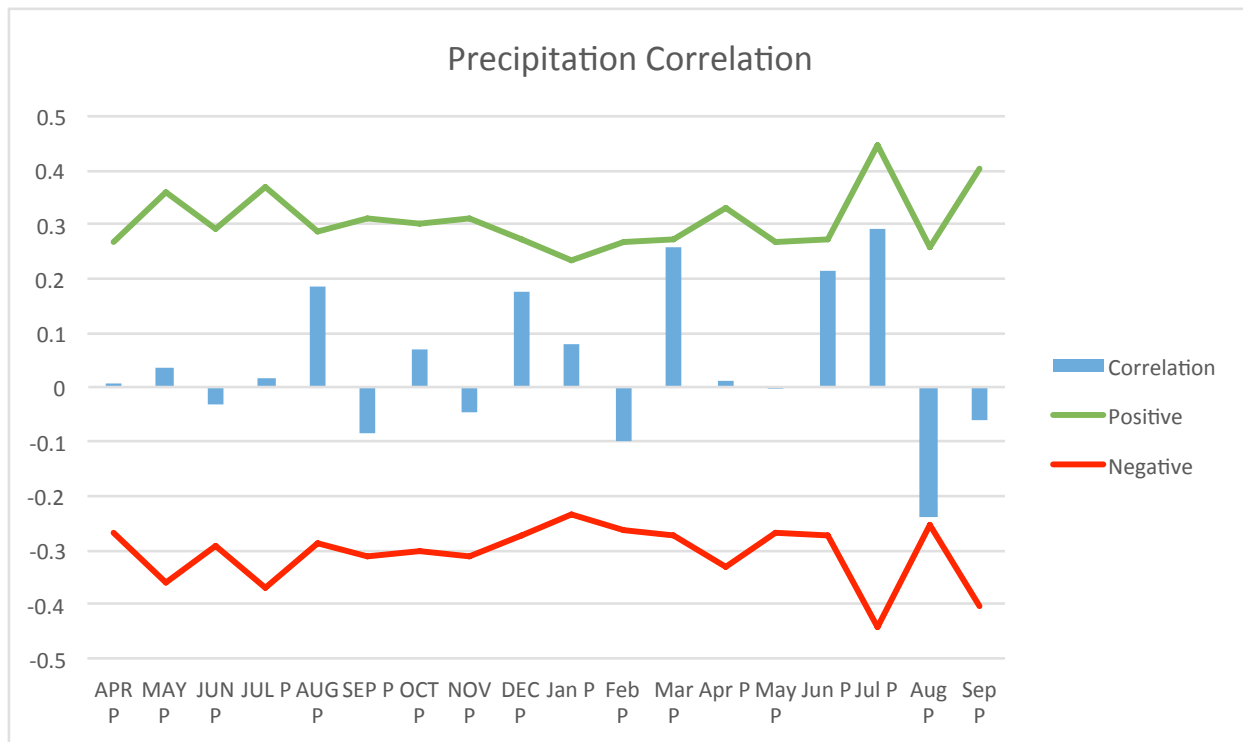


Figure 3: Results of the climate analysis comparing annual tree-ring growth to historical precipitation variables from Regina, SK.

Conclusion

The results of this analysis help to strengthen our record of hybrid poplar growth over time within Saskatchewan's southeast. They also provide us with an understanding of the important climate variables driving tree growth in southeastern Saskatchewan, in this case there was no significant relationship between precipitation and tree growth, but the temperature relationships indicate that there is a spring moisture deficit issue. 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 hybrid poplar 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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