A Dendrochonological Analysis of Canadian Prairie Shelterbelts: Whelan Farm.

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MAD Lab Report 2014-24

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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 examined. At the Whelan farm site, Scots pine (*Pinus sylvestris*) samples were collected from 20 trees, and the oldest samples were 42-years old with an average age of 35.

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 off-set 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: 14OLS00	Date: July 17, 2014
Site Name: Whelan Farm	Site Contact Info: Thomas and Marlene Whelan
Latitude: 52° 10’ 23.04”	Longitude: 106° 52’ 19.59”
UTM: 5781995 03711981	UTM Zone: 13U
MASL (m above sea level): - m	
Satellites: 11	Precision: ± 5m

Species Common Name: Scots pine

MAD Lab Species Code: S00

Methods

The MAD Lab sampled 20 Scots pine 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 created a growth pattern, which could then be matched against the other cores from that site, in order to create a master chronology, which would demonstrate the overall tree

growth patterns through time. The master chronologies were 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 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 42-years old at breast height, while the average age of all trees at the site was 35. This suggests they were planted at the end of the 80's, which is in agreement with the database provided from the Prairie Farm Rehabilitation Association, which indicates that Scots pine were sent there from between '86 and '89. The average raw ring-width measurement was determined to be 3.23 mm (see Figure 1 for the standardized growth of the tree over time). The climate data from the Saskatoon station indicated that March precipitation of the current year and may temperature of the current growth year were the strongest climate variables affecting the tree growth (see Figures 2 and 3). The effect in was positive.

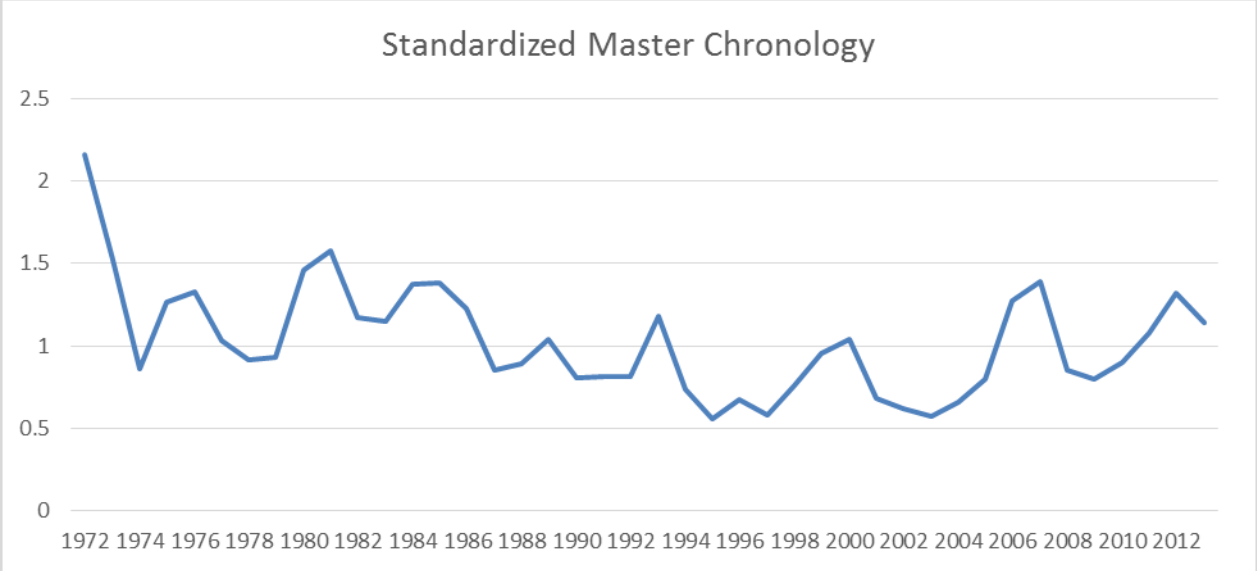

Figure 1: Master chronology for Scots pine at the Whelan farm site. Standardized measurements of 1.00 indicate an average year of growth (in this case, associated with a raw ring-width of 2.23 mm), while any value above or below 1.00 indicate a year of growth that deviates from the average.

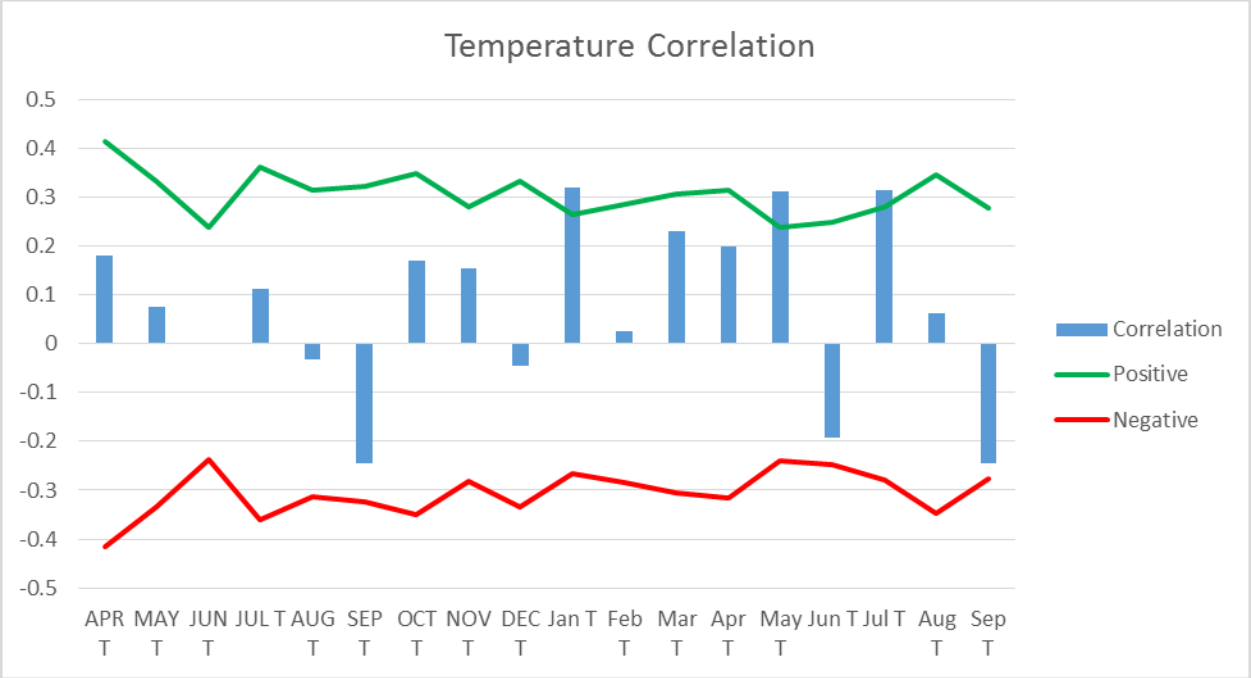

Figure 2: Results of the climate analysis comparing annual tree-ring growth to historical temperature variables from Saskatoon, SK. The bars represent the degrees of correlation between the tree growth and the climate variable. The places where the bars cross the linear threshold are considered significantly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

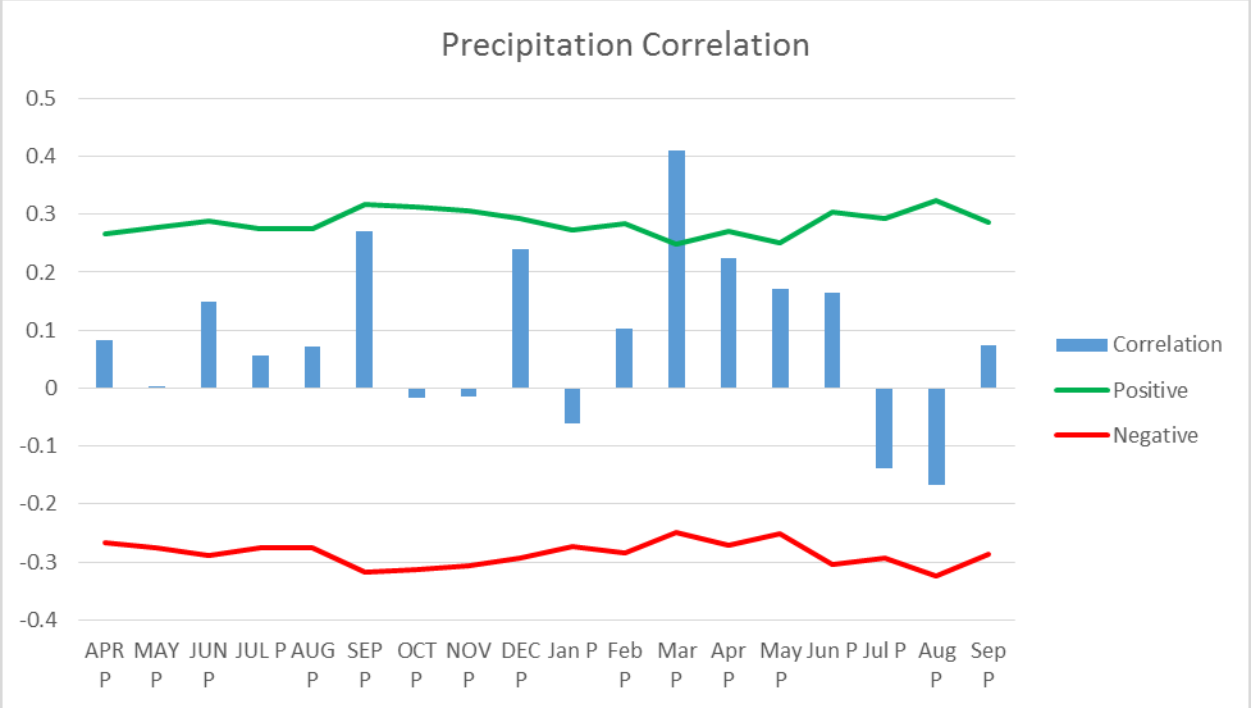

Figure 1: Results of the climate analysis comparing annual tree-ring growth to historical precipitation variables from Saskatoon, SK.

Conclusion

The results of this analysis help to strengthen our record of Scots pine growth over time within central Saskatchewan. They also provide us with an understanding of the important climate variables in central Saskatchewan, in this case May temp and March precipitation. The data used from this site will be used in future studies, which will attempt to determine future growth trends and the amount of carbon sequestered by white spruce to determine its potential and viability in 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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