

# **A Dendrochronological Analysis of Canadian Prairie Shelterbelts: Fleishhacker Farm**



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MAD Lab Report 2014- 14

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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 Fleishhacker’s site, scots pine samples were collected from 20 trees, and the oldest samples were 70-years old with an average age of 36. The main climatic factors driving tree growth at this site are a negative relationship to summer temperatures and a positive relationship to July precipitation.

## **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 2013, 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: 13PLS00

Date: June 3, 2013

Site Name: Fleischhacker Farm

Site Contact Info: Michael Fleischhacker

Latitude: 52° 23' 06.6"

Longitude: -105° 12' 42.8"

UTM: 0485581 5803901

UTM Zone: 13U

MASL (m above sea level): 573m

Satellites: 10

Precision: ± 5m

Species Common Name: Scots pine

MAD Lab Species Code: S00

## **Methods**

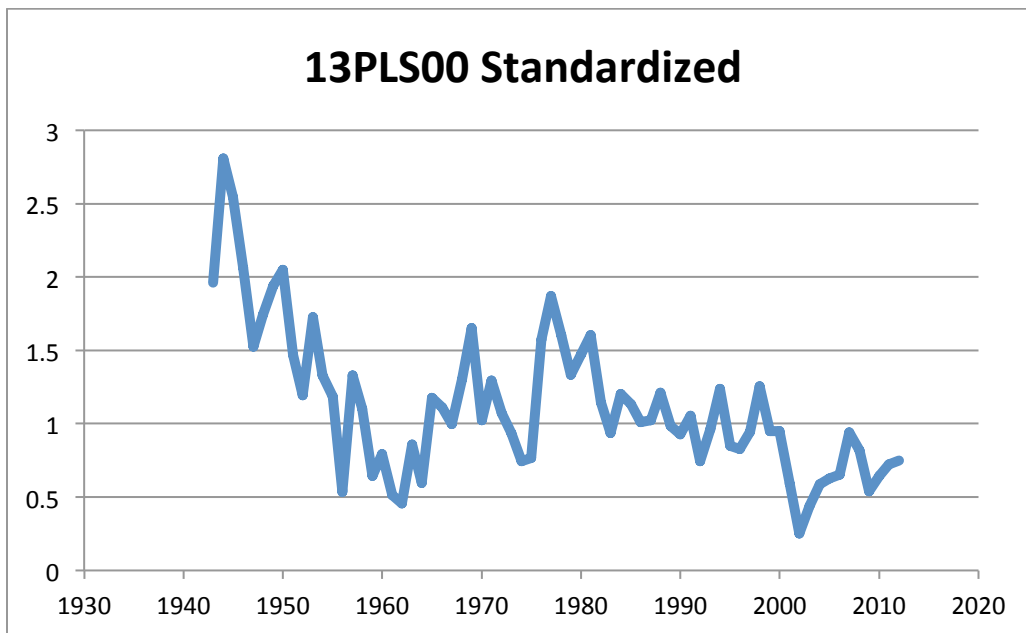
The MAD Lab sampled 20 Scots pine trees, using a 5.1 mm increment borer to take two core samples from each tree at approximately breast height. These samples were stored in plastic straws and taken back to the MAD Lab in Saskatoon, Saskatchewan for analysis. The samples were glued into slotted mounting 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 Pilger 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.

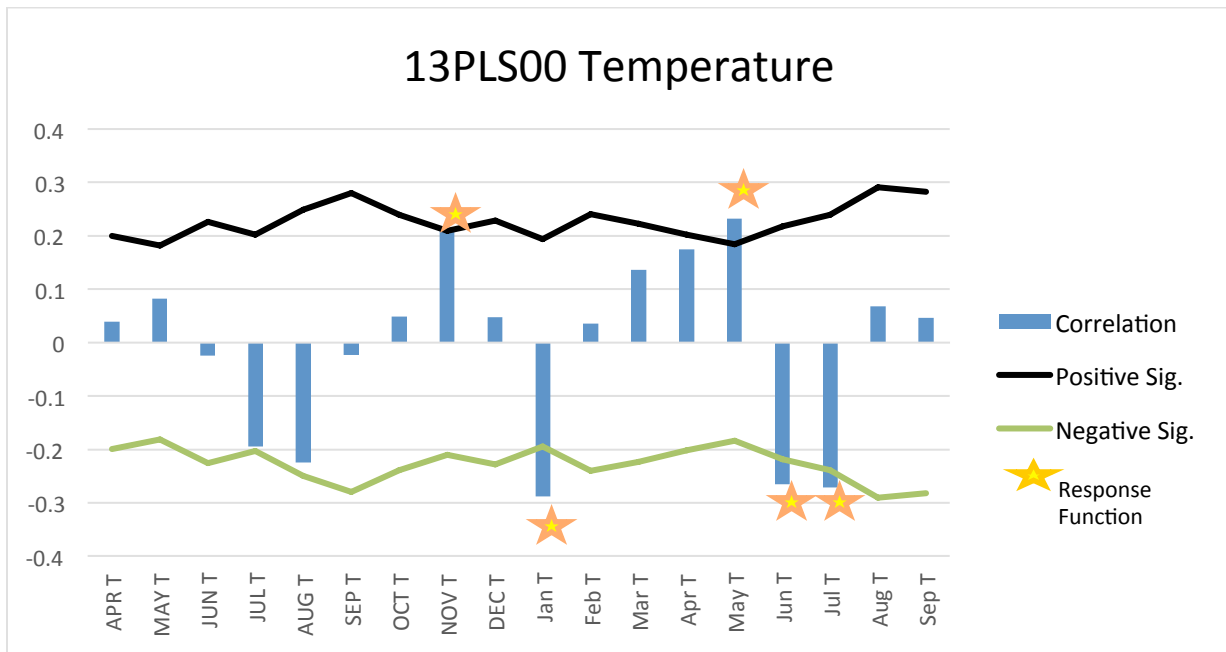
## Results and Discussion

The oldest samples were determined to be 70-years old at breast height, while the average age of all trees at the site was 36. This suggests they were planted in the mid-70's, though there are some older pines on the site. These trees would have been planted at a similar time to the rest of the trees ordered through the Prairie Farm Rehabilitation Association, which was between 1978 and 1980. The average raw ring-width measurement was determined to be 2.75 mm (see Figure 1 for the standardized growth of the tree over time).

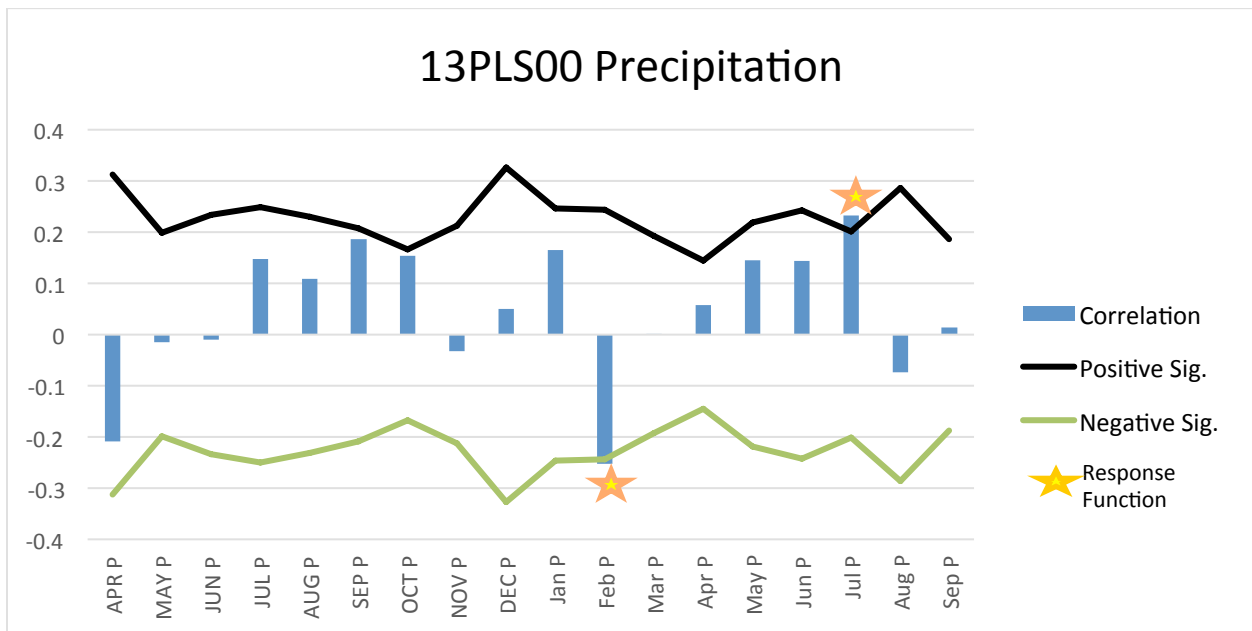
The climate data from the Pilger station indicated that January, May, June, and July were the months in which temperature most greatly impacted tree growth, primarily by a negative relationship to summer (June and July) temperature. Precipitation during July had the greatest influence on tree growth (see Figures 2 and 3).



**Figure 1:** Master chronology for scots pine at the Fleischhacker site. Standardized measurements of 1.00 indicate an average year of growth (in this case, associated with a raw ring-width of 2.75 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 Pilger, 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, marked by a star. 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 Pilger, SK.

## **Conclusion**

The results of this analysis help to strengthen our record of Scots pine growth over time within Saskatchewan's northeast. They also provide us with an understanding of the important climate variables in northeast Saskatchewan, in this case, June and July for temperature, and July for 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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