A Dendrochronological Analysis in Canadian Prairie Shelterbelts:

Seymour's Farm

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MAD Lab Report 2012-12

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Mount Allison Dendrochronology Lab

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Abstract

To determine the carbon storage capacity of shelterbelt trees and their response to climate variables, the Mount Allison Dendrochronology Lab conducted a tree-ring analysis on nine of the most commonly planted shelterbelt species in the Canadian Prairies. Traditional cross-dating and climate analyses techniques were used to reveal a variety of temporal patterns in tree-growth. At Seymour's Farm, Scots pine samples were collected for analyses and it was determined that the oldest trees sampled were 84 years old at the diameter at breast height.

Introduction

In the summer of 2011, the Mount Allison Dendrochronology Lab travelled to Saskatchewan to sample shelterbelt trees as part of the Agricultural Greenhouse Gas Program (in association with the University of Saskatchewan). The objective of the larger project is to determine the carbon storage capacity of shelterbelt trees in order to determine their ability to off-set carbon emissions and act as potential carbon credits for landowners.

Samples for this project were collected around south-central Saskatchewan throughout the summer of 2011 for a dendrochronological (tree-ring) analysis in an effort to reveal the climatic factors that have had the greatest impact on annual-tree growth for the tested species. The objective of this sampling was to determine the age and growth patterns of nine of the most commonly planted shelterbelt species. As a landowner and thus a stakeholder in this project, we would like to provide you with the results of our findings on your property.

Site Information

MAD Lab Site Code: 11IL **Date:** MAY 26, 2011

Site Name: SEYMOUR'S FARM **Site Contact Info:** DONNA AND STAN

Latitude: N 52° 07' 28.7" TOWNSHIP – 36 RANGE - 9

Longitude: W 107° 14' 32.9" SEC – 29 ¼ - NE W3

UTM: 648, 727

UTM Zone: 13 U

MASL: 533 m

Satellites: 9

NAD: 83

Elevation: 533 m

Easting: 0346487

Northing: 5777273

Species Common Name: Scots pine

MAD Lab Species Code: S00

Methods

Forty tree cores were sampled from each species using a 5.1 mm increment borer. The samples were stored in plastic straws and transported to the Mount Allison Dendrochronology Lab for analysis. The samples were glued into slotted mounting boards, and then sanded and buffed to a fine polish in order to reveal the tree rings. Annual-growth rings were counted and measured using a mounted measuring stage and 60X microscope. The individual core measurements were crossdated (pattern-matched) against other cores within their group to establish the years that had increased or suppressed radial growth. A master chronology was established for each species at each site, demonstrating the overall tree-growth patterns through time.

Annual tree-ring measurements were then compared to historical temperature and precipitation data from the Saskatoon climate station in order to determine the major environmental factors influencing the tree's growth. The resulting statistical correlations allow us to infer the climate variables that play the most significant role in the growth of each shelterbelt species.

Results

The oldest sampled Scots pine trees on the property were found to be 84 years old at breast height, suggesting that they were planted in the mid 1920's (Fig. 1). The mean ring-width measurement was determined to be 1.56 mm.

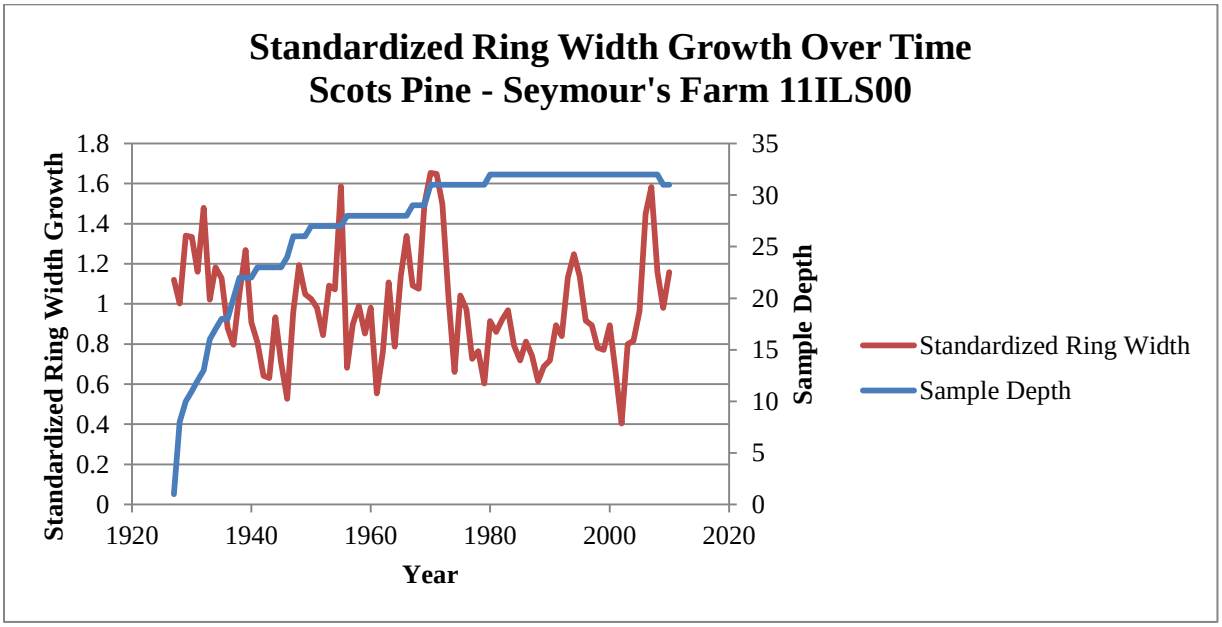

Fig. 1 - Master chronology for Scots Pine (11ILS00) at Seymour's Farm. A standardized measurement of one indicates an average year of growth, while any value above or below one indicates a year of above or below average growth.

The Scots pine samples collected at Seymour's Farm suggest that many climate variables play a role in determining annual growth patterns. June precipitation, January precipitation, and the temperature of May of the previous year appear to be the most significant drivers of radial growth. June precipitation is positively correlated with tree growth, as moisture early in the growing season is critical to overall growth. January precipitation is related to snow pack. More snow (precipitation) during the winter months suggests that there will be more melt water available early on in the new growing season. The temperature of the month of May in the previous year is negatively related to growth during the current year. This could be a result of the inter-annual ramifications of a poor growing season, as warm May temperatures are linked to decreased soil moisture content.

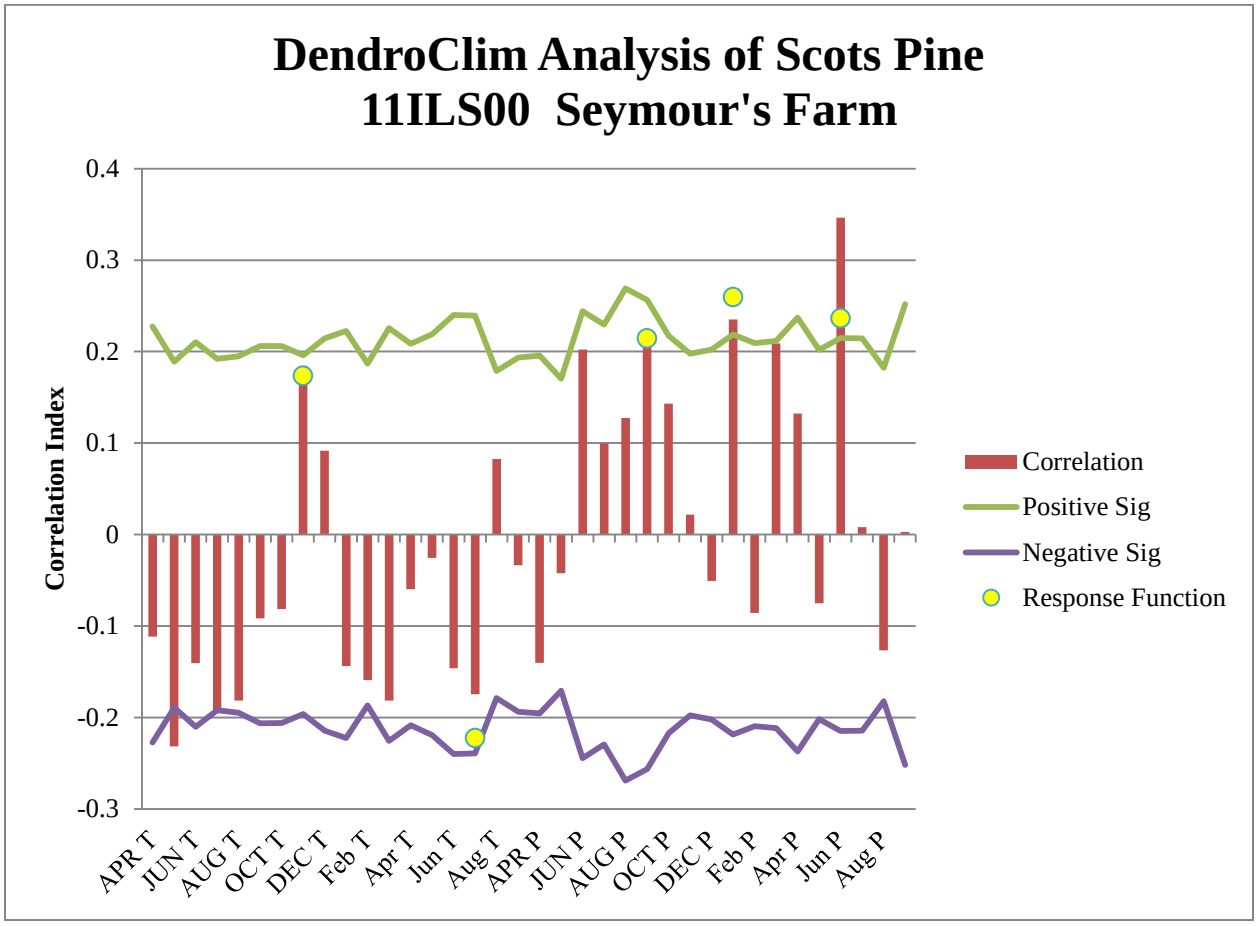

Fig. 2 - Results of the climate analysis comparing annual tree-ring growth to historical temperature and precipitation variables from Saskatoon. Bars represent the degree of correlation between growth and the climate variable, with anything surpassing the linear thresholds being considered significantly correlated. The uppercase letters (i.e. APR T) present variables from the previous year (for example, the conditions of the previous fall often have an impact on tree growth during the current year).

Conclusion

The results of these analyses have proved useful for determining the significant climatic variables influencing the annual growth of Scots pine in shelterbelts in south-central Saskatchewan. The data obtained through this study will aid in inferring the future growth trends of shelterbelt species under different future climate change scenarios. The eventual aim is to use this information to quantify the amount of carbon sequestered by each shelterbelt tree on an annual basis to demonstrate their potential as carbon credits.

This research was conducted at the Mount Allison Dendrochronology Lab in Sackville, New Brunswick. Any questions regarding the findings of this report should be directed to:

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Thank you for your participation in this project!