A Dendrochronological Analysis in Canadian Prairie Shelterbelts:

Kevin and Lori Walker Farm

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MAD Lab Report 2012-25

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Table of Contents

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 the Walker property, white spruce samples samples were collected for analysis and it was determined that the oldest trees were aged 40 years.

Introduction

The Mount Allison Dendrochronology Lab travelled to Saskatchewan in July 2012 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 throughout south-central Saskatchewan in the summer of 2012 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: 12ZL

Date: July 9, 2012

Site Name: Walker Farm

Site Contact Info: Kevin and Lori Walker

Latitude: N 51° 31’ 59.1”

Longitude: W 108° 03’ 42.7”

UTM: 0703958 5713147

UTM Zone: 12 U

Satellites: 6

NAD: 83

MASL (m above sea level): 606m

Species Common Name: White Spruce

MAD Lab Species Code: 200

Methods

Forty tree cores were sampled using a 5.1 mm increment borer. These samples were stored in plastic straws and taken back to the Mount Allison Dendrochronology Lab in Sackville, New Brunwsick, for analysis. These samples were glued onto 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 and tree-rings. 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, demonstrating the overall tree-growth patterns through time.

In order 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 influence the growth of the trees at each site.

Results

The oldest sampled white spruce trees on the property were found to be 40 years old (Fig. 1). The mean ring-width measurement was determined to be 2.96 mm.

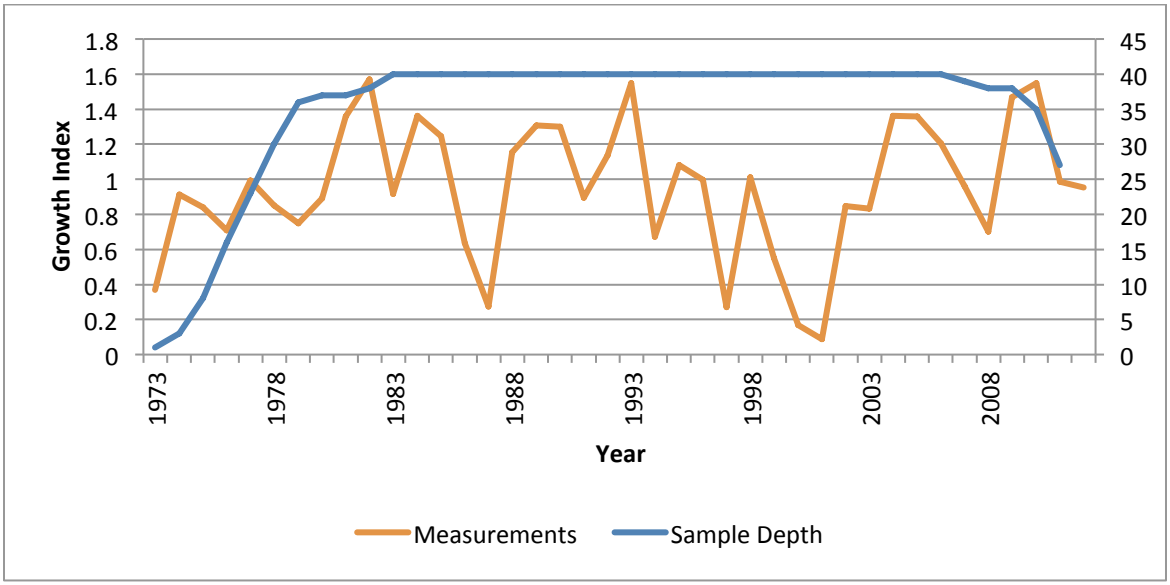

Fig. 1: Master chronology for white spruce (12ZL200) at the Walker Farm. Standardized measurements of 1 (in this case, 2.96 mm) indicate an average year of growth, while any value above or below one indicate a year of above or below average growth. Sample depth is the number of samples averaged to produce the ring measurement for that year.

The climate factors that had the largest impact on the annual ring width variation of acute willow were previous July and November temperature (positive correlation), previous July precipitation (negative), and current September temperature (negative) (Fig. 2).

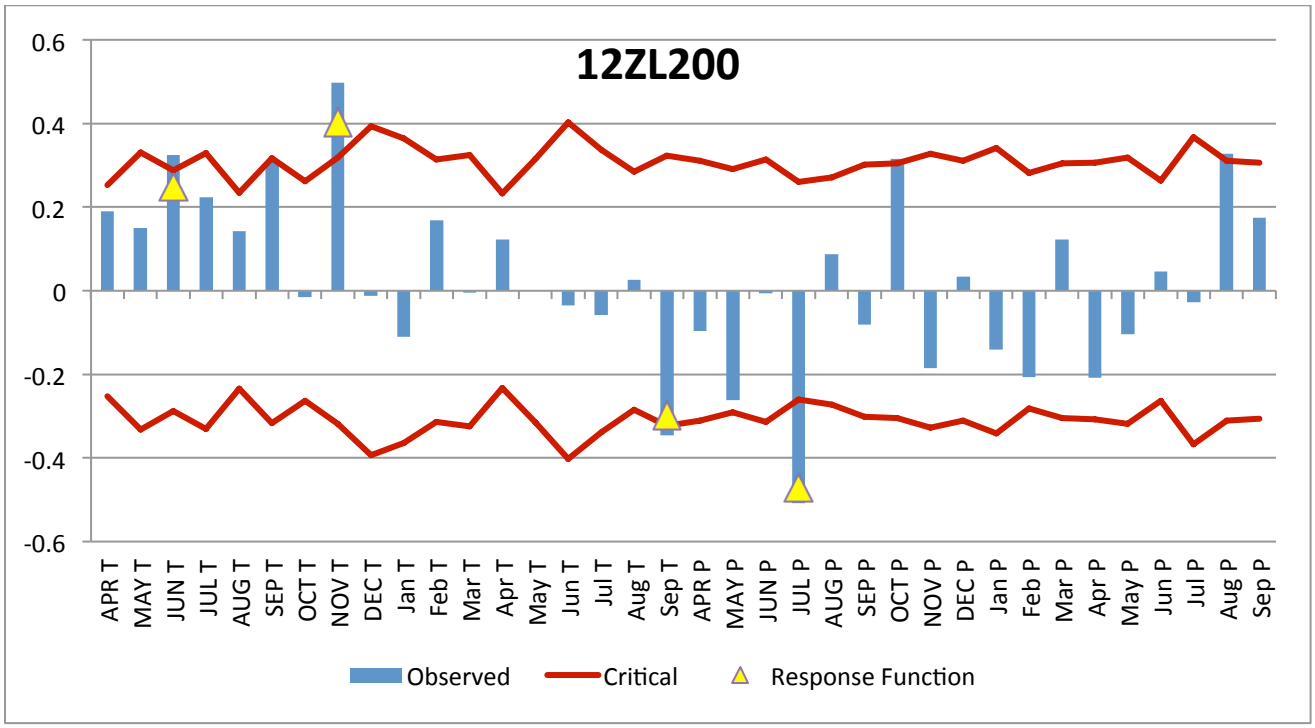

Fig. 2 Results of the climate analysis comparing annual tree-ring growth to historical temperature (T) and precipitation (P) variables from the Saskatoon climate station. Bars represent the degree of correlation between growth and the climate variable, with anything surpassing the linear thresholds being 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 white spruce trees in shelterbelts in 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!