A Dendrochronological Analysis in Canadian Prairie Shelterbelts:

Sorestad Farm

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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 the Sorestad farm, white spruce samples were collected for analyses and it was determined that the oldest trees were aged 60 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 around south-central Saskatchewan throughout 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: 12AJL

Date: July 13, 2012

Site Name: GMOsquito

Site Contact Info: Clifford Sorestad

Latitude: N 51° 41' 37.7"

Longitude: W 102° 41' 50.7"

UTM: 0659141 5729494

UTM Zone: 13 U

Satellites: 5

NAD: 83

Elevation (ASL): 505 m

Species Common Name: White Spruce

MAD Lab Species Code: 200

Methods

Forty white spruce (*Picea glauca*) 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 onto slotted mounting boards, and then progressively sanded (60 to 600 grit) 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 60 X 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 white spruce trees on the property were found to be 60 years old (Fig. 1). The mean ring-width measurement was determined to be 3.07 mm.

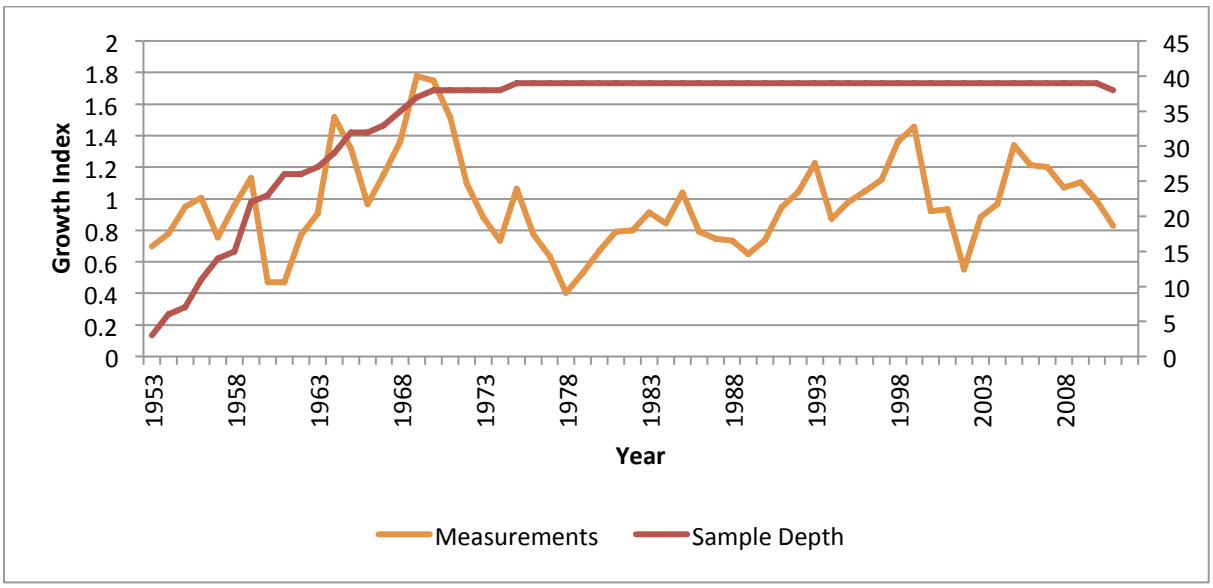

Fig. 1 Master chronology for white spruce (12AJL200) at the Sorestad farm. A standardized measurement of one indicates an average year of growth (in this case, 3.07 mm), while any value above or below one indicates a year of above or below average growth. Sample depth is the number of samples averaged to produce the ring measurement for that year.

Previous May temperature (negative), previous September temperature (positive), and May precipitation (positive) were shown to have the best correlations and most explanatory power.

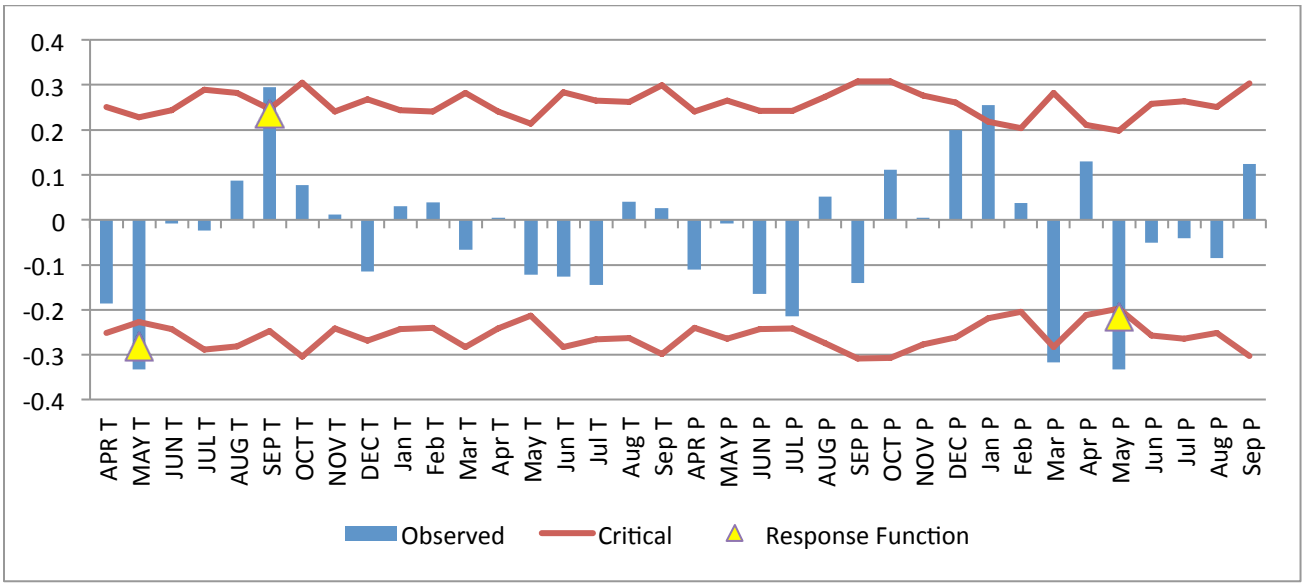

Fig. 2 Results of the climate analysis comparing annual tree-ring growth to historical temperature (T) and precipitation (P) variables from the region. Bars represent the degree of correlation between growth and the climate variable, with anything surpassing the linear thresholds being considered significantly 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!