

# **A Dendrochronological Analysis in Canadian Prairie Shelterbelts:**

## **Chief Spruce**



Bryan J. Mood, Emily Hogan, Jason Maillet, Cecilia Jennings, Mariana Trindade and Colin P. Laroque

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Mount Allison University, Department of Geography and the Environment  
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 the Chief Spruce site, white spruce samples were collected for analyses and it was determined that the oldest trees were aged 41 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:** 12AKL

**Date:** July 14, 2012

**Site Name:** Chief Spruce

**Site Contact Info:** Abandoned Farm

**Latitude:** N 51° 56' 44.4"

**Longitude:** W 104° 33' 03.6"

**UTM:** 0520861 5755091

**UTM Zone:** 13 U

**Satellites:** 9

**NAD:** 83

**Elevation (ASL):** 524 m

**Species Common Name:** White Spruce

**MAD Lab Species Code:** 200

## **Methods**

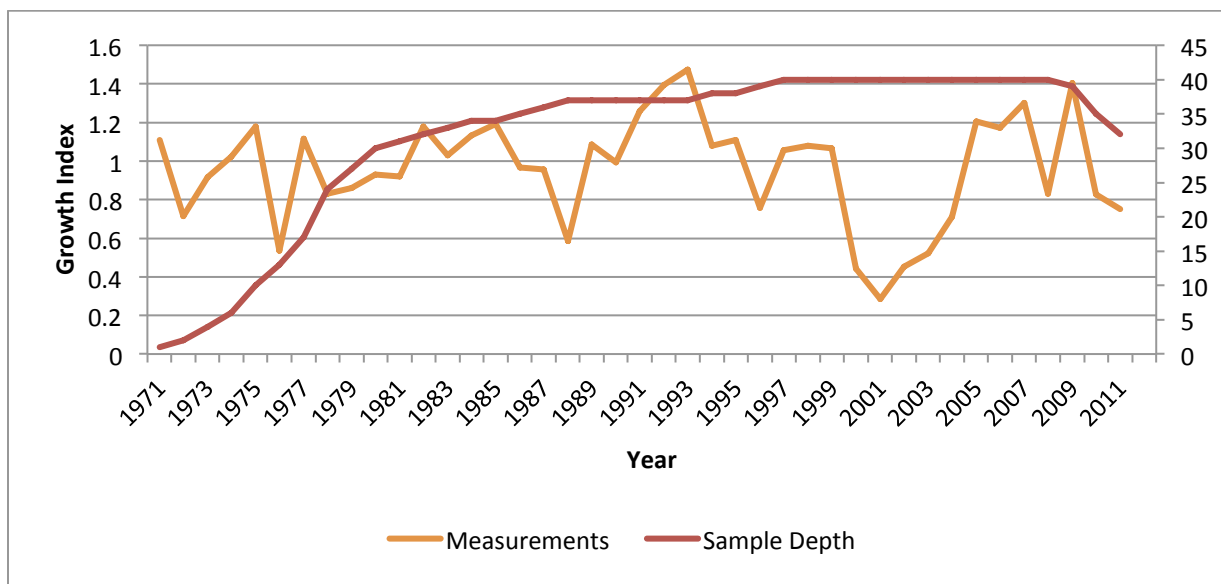
Forty white spruce (*Picea glauca*) tree cores were sampled from each species using a 5.1 mm increment borer. The samples were stored in plastic straws and transported to the Mount Allison Dendrochronology Lab for analysis. The samples were glued onto slotted mounting boards, and then sanded and buffed to a fine polish in order to reveal the tree rings. Annual

growth-rings were counted and measured using a mounted measuring stage and 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 a regional 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.

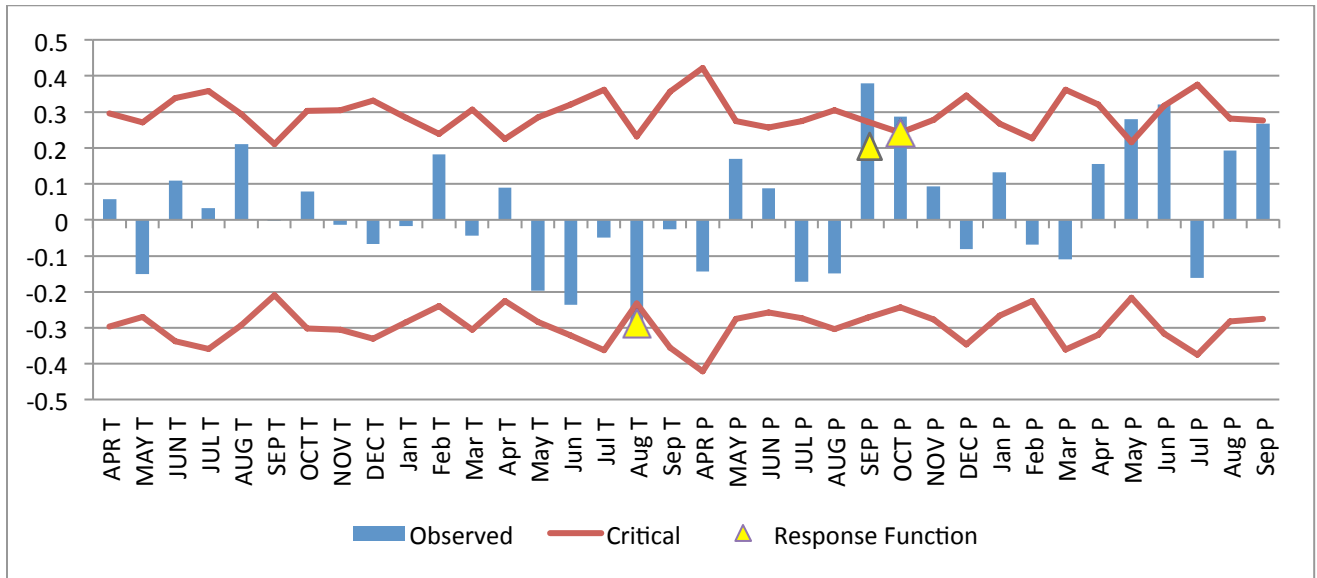
## Results

The oldest sampled white spruce trees on the property were found to be 41 years old (Fig. 1). The mean ring-width measurement was determined to be 3.89 mm.



**Fig. 1** Master chronology for white spruce (12AKL) at the Chief Spruce site. A standardized measurement of one indicates an average year of growth (in this case, 3.89 mm), while any value above or below one indicates a year of above or below average growth. Sample depth (right axis) is the number of samples averaged to produce the ring measurement for that year.

August temperature (negative), previous September and October 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:

**Dr. Colin Laroque**

Professor, MAD Lab Director  
University of Saskatchewan  
Department of Soil Science  
Room 5C10, Agriculture Building  
51 Campus Drive,  
Saskatoon, SK  
S7N 5A8  
Phone: 306-966-2493  
Fax: 306-966-6881  
E-mail: [colin.laroque@usask.ca](mailto:colin.laroque@usask.ca)

Thank you for your participation in this project!