A Dendrochronological Analysis in Canadian Prairie Shelterbelts:

Pickett's Farm

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MAD Lab Report 2012-13

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Mount Allison Dendrochronology Lab

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Abstract

To determine the carbon storage capacity of shelterbelt species 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 and shrub growth. At Pickett's Farm, caragana samples were collected for analyses and it was determined that the oldest shrubs were aged 34 years at the diameter at breast height.

Introduction

In the summer of 2011, the Mount Allison Dendrochronology Lab travelled to Saskatchewan to sample shelterbelt trees and shrubs 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 species 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 and shrub 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: 11KL **Date:** MAY 28, 2011

Site Name: PICKETT'S FARM **Site Contact Info:** KATHY& MURRY

Latitude: N 52° 04' 57.2"

Longitude: W 107° 18' 45.9"

UTM: 153, 274

UTM Zone: 13 U

MASL: 545 m

Satellites: 7

NAD: 83

Elevation: 545 m

Easting: 0341534

Northing: 5772744

Species Common Name: Caragana

MAD Lab Species Code: TOO

Methods

Twenty shrubs samples were collected using a reciprocating saw. The samples were stored in breathable bags and were transported to the Mount Allison Dendrochronology Lab for analysis. The samples were sanded and buffed to a fine polish in order to reveal annual-growth rings. The rings were counted and measured using a mounted measuring stage and 60X microscope. The individual measurements were crossdated (pattern-matched) against other samples 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 shrub-growth patterns through time.

Annual 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 shrub'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 caragana stems on the property were found to be 37 years old (Fig. 1). It is possible, however, that the shrubs were planted before this date, as new shoots are produced by the shrub each year (the age of the stems are likely less than the age of the shrub). The mean ring-width measurement was determined to be 0.92 mm.

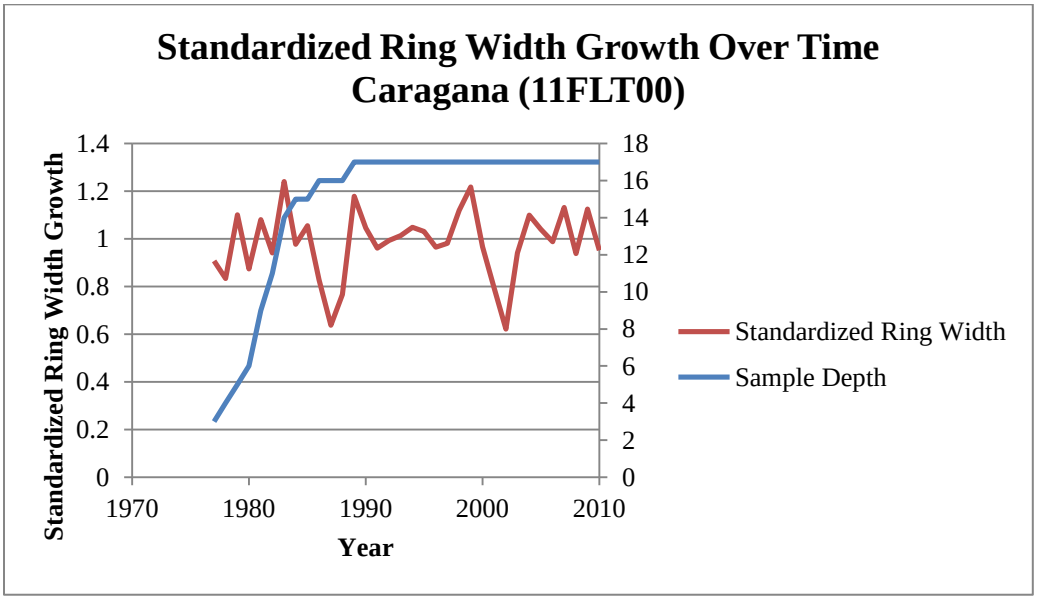

Fig. 1 - Master chronology for caragana (11KLT00) at Pickett's Farm. A standardized measurement of one indicates an average year of growth, while any value above or below one indicates a year of above or below average growth.

The three main climate factors (May temperature (negative correlation), June temperature (negative), and June precipitation (positive)) accounted for 37% of the annual variability in its ring-width growth. The temperatures of May and June are likely negatively correlated to caragana growth because warm temperatures during these months decrease the amount of soil moisture available for the shrubs early in the growing season. June precipitation has a positive relationship with shrub growth as it replenishes moisture to the soil.

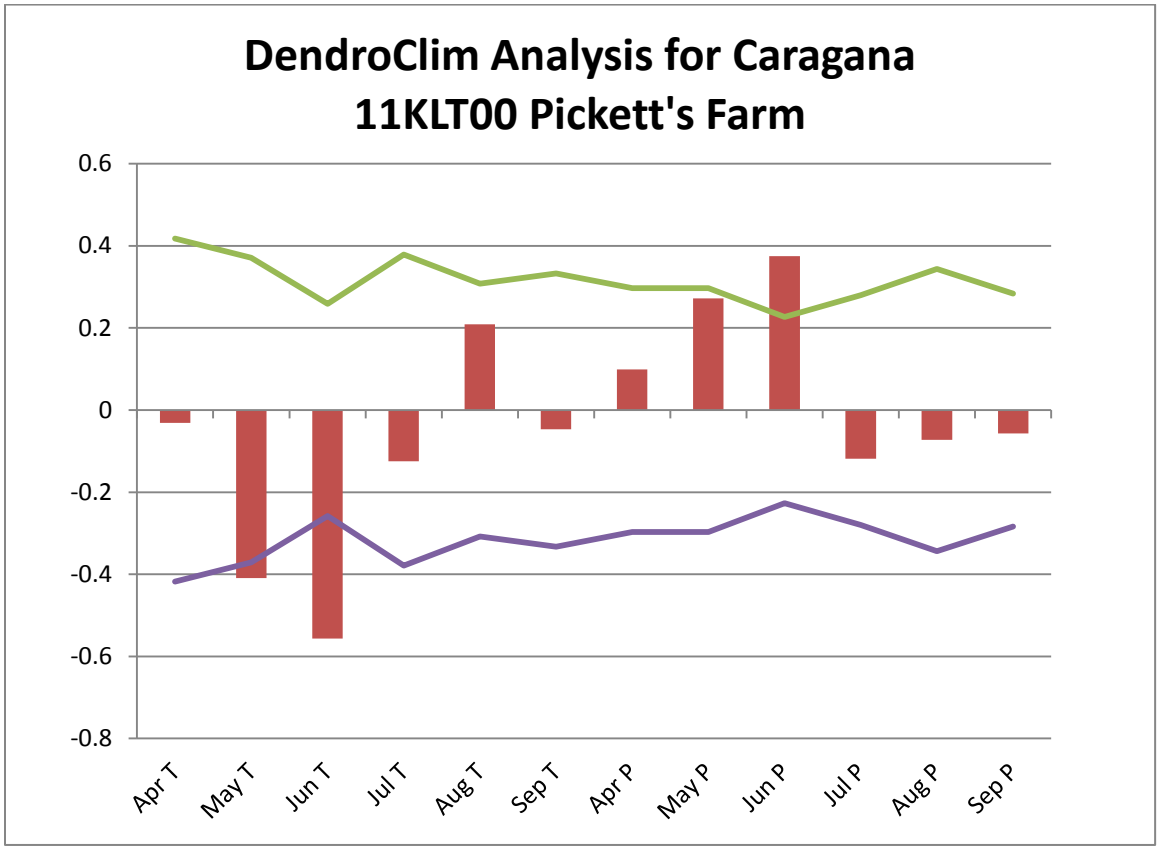

Fig. 2 - Results of the climate analysis comparing annual ring growth to historical temperature and precipitation variables from Saskatoon. Bars represent the degree of correlation between growth and the climate variable, with anything surpassing the linear thresholds being considered significantly correlated.

Conclusion

The results of these analyses have proved useful for determining the significant climatic variables influencing the annual growth of caragana in shelterbelts in south-central Saskatchewan. Prior to this study, no similar dendrochronological analysis had taken place using caragana. 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 shrub 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!