A Dendrochonological Analysis of Canadian Prairie Shelterbelts: Zyrmiak Farm

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Mistik Askiwin Dendrochronology Lab

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Abstract

As a part of the Agricultural Greenhouse Gases Program, which seeks to determine the carbon sequestration capabilities of shelterbelt trees and their response to climate and climate change, the Mistik Askiwin Dendrochronology Lab conducted a tree-ring analysis on shelterbelt trees throughout Saskatchewan. Using dendrochronological cross-dating techniques, a hybrid poplar growth chronology was built based on radial growth measurements from trees growing at the Zyrmiak site. At this site, hybrid poplar samples were collected from 20 trees, and the oldest samples were determined to be 37-years old with an average age of 31. It was also found that the hybrid poplar growing at this site is growing similarly to other hybrid poplar in the province.

Introduction

The Mistik Askiwin Dendrochronology Lab (MAD Lab), located at the University of Saskatchewan, is currently involved in a project for the Agricultural Greenhouse Gases Program (AGGP), which is investigating the capability of shelterbelt trees to store carbon. The carbon storage capability of these trees will inform their ability to off-set carbon emissions and potentially act as carbon credits. The objective of the larger project is to determine the current and future capacity of carbon sequestration in these shelterbelt trees.

In the summer of 2013, samples for this project were collected across most of Saskatchewan. These samples were used as a part of the larger study, looking at shelterbelt tree growth over time since the trees were planted. As a landowner, and therefore a stakeholder in this project, we would like to provide you with the results from our findings on your property.

Site Information

MAD Lab Site Code: 13NLN00

Date: June 2, 2013

Site Name: Zyrmiak Farm

Site Contact Info: Elaine Zyrmiak

Latitude: 51° 12’ 23.5”

Longitude: -103° 21’ 34.7”

UTM: 0614590 5674070

UTM Zone: 13U

MASL (m above sea level): 677 m

Satellites: 10

Precision: ± 5m

Species Common Name: Hybrid Poplar

MAD Lab Species Code: N00

Methods

The MAD Lab sampled twenty hybrid poplar trees, using a 5.1 mm increment borer to take two core samples from each tree at approximately breast height. These samples were stored in plastic straws and taken back to the MAD Lab in Saskatoon, Saskatchewan for analysis. The samples were glued into 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 of the tree rings. The annual-growth rings were measured under a microscope using a Velmex stage system with a precision of 0.001 mm. The measurements from each core created a growth pattern, which could then be matched against the other cores from that site, in order to create a master chronology, which would demonstrate the overall tree growth patterns through time. The master chronologies were then standardized to remove age related and biological growth trends, providing a cleaner signal. The resulting standardized

growth chronology was compared to other hybrid poplar sites in the province to see whether hybrid poplar growth is synchronous over time. Pearson product moment correlation was used to evaluate the relationship between tree-growth at hybrid poplar sites in the province.

Results and Discussion

The oldest tree was found to be 37-years old at breast height, while the average age of all trees at the site was 31. This suggests they were planted in the mid-80's, which is in agreement with the database provided from the Prairie Farm Rehabilitation Association, which indicates that the hybrid poplar were sent there in 1981. The average raw ring-width measurement was determined to be 3.52 mm (see Figure 1 for the standardized growth of the tree over time). In this case, three other hybrid poplars were sampled throughout the province, allowing for multiple correlations. The Pearson correlation revealed that the hybrid poplar from the Zyrmiak site correlated to the 95% confidence interval with all other sampled hybrid poplars in Saskatchewan, indicating that the hybrid poplar growth at all the sites are closely related (Figures 2, 3, 4, and 5) and (Table 1 and 2).

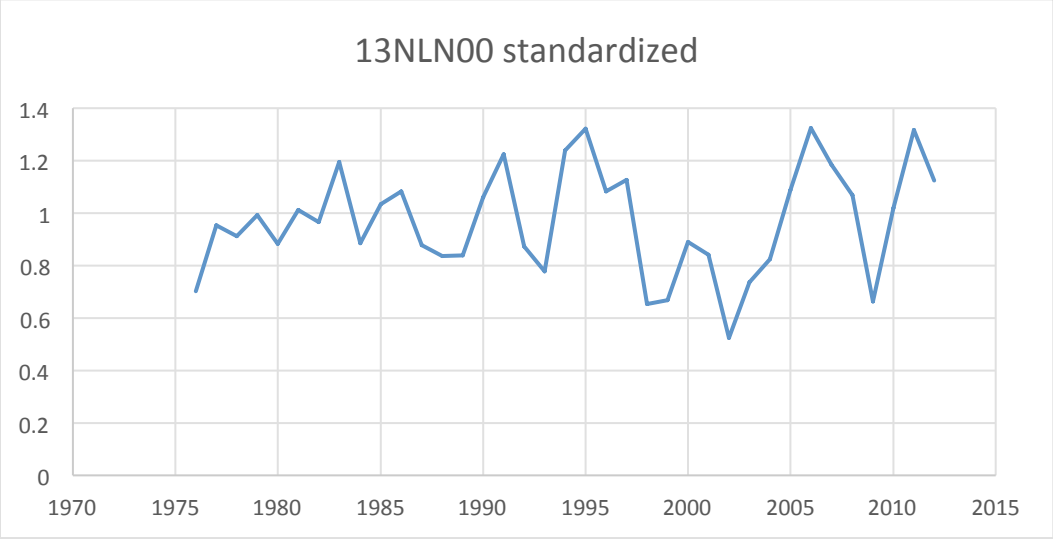

Figure 1: Master chronology for hybrid poplar at the Zyrmiak site. Standardized measurements of 1.00 indicate an average year of growth (in this case, associated with a raw ring-width of 3.52 mm), while any value above or below 1.00 indicate a year of growth that deviates from the average.

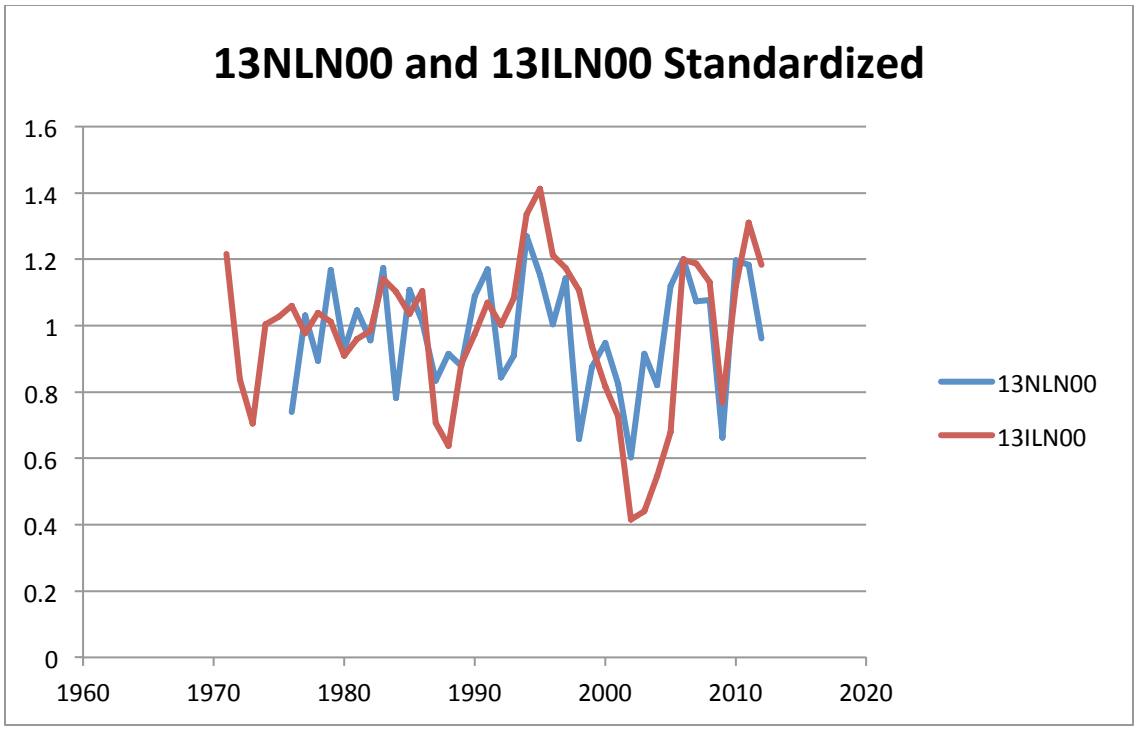

Figure 2: Comparing hybrid poplar standardized growth from the Zyrmiak site to grow at another hybrid poplar site within Saskatchewan.

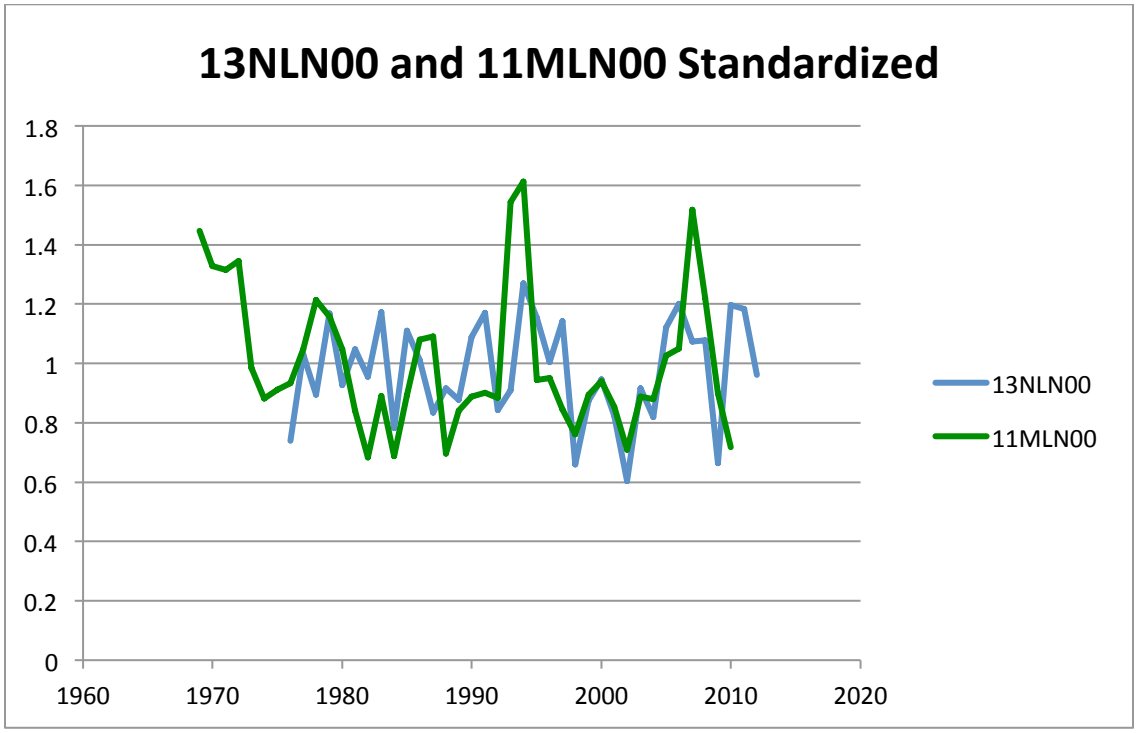

Figure 3: Comparing hybrid poplar standardized growth from the Zyrmiak site to grow at another hybrid poplar site within Saskatchewan.

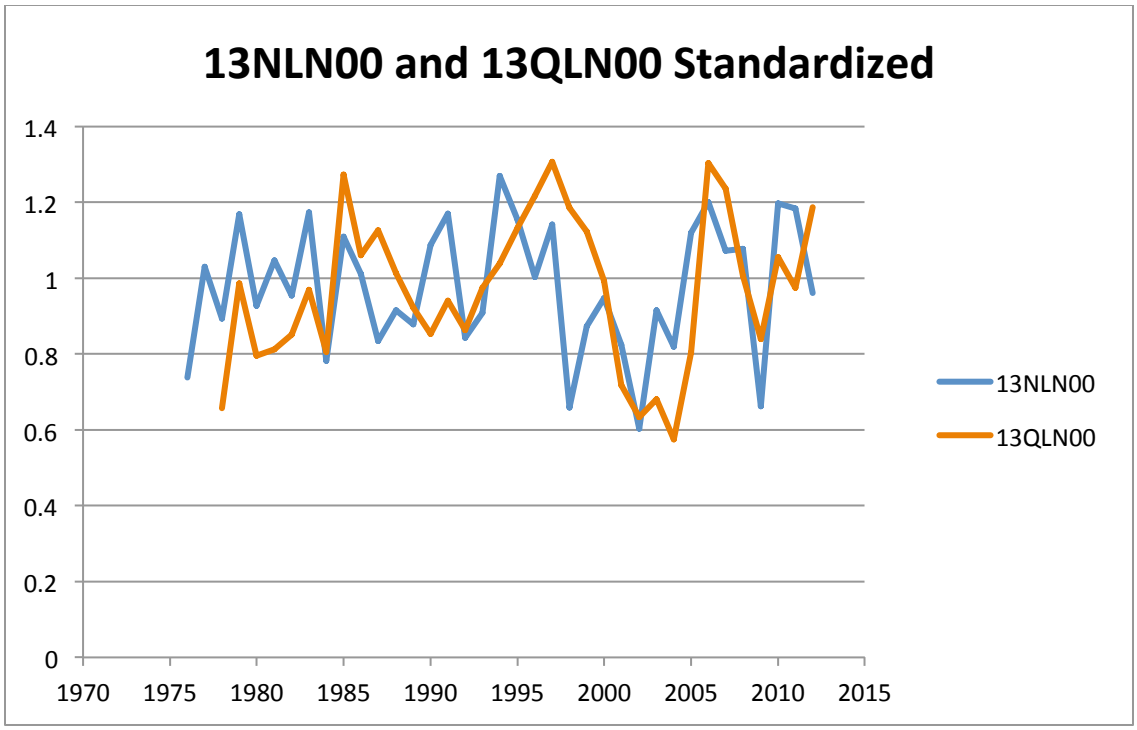

Figure 4: Comparing hybrid poplar standardized growth from the Zyrmiak site to grow at another hybrid poplar site within Saskatchewan.

Figure 5: Location of the four hybrid poplar sites in relation to Saskatoon and Regina.

Table 1: Pearson correlation coefficients from the Zyrmiak site in comparison to other hybrid poplar sampled in Saskatchewan.

Column1	13NLN00	13ILN00	13QLN00	11MLN00
13NLN00	1	0.56634201	0.428080388	0.345523853
13ILN00	0.56634201	1	0.63220373	0.339652539
13QLN00	0.428080388	0.63220373	1	0.206620028
11MLN00	0.345523853	0.339652539	0.206620028	1

Table 2: Confidence intervals indicating how closely correlated each site is related.

Column1	p-value	99%	95%
NLN x ILN	0.00015878	x	x
NLN x QLN	0.00577424	x	x
NLN x MLN	0.02637762		x
ILN x QLN	0.00003025	x	x
ILN x MLN	0.01719608		x
QLN x MLN	0.12826876		

Conclusion

The results from this analysis help to strengthen our record of hybrid poplar growth over time within Saskatchewan. It can also be said with a certain level of confidence that hybrid poplar at the Zyrmiak site is growing similarly to other hybrid poplar within the province. The data used from this site will be used in future studies, which will attempt to determine future growth trends and the amount of carbon sequestered by hybrid poplar to determine its potential and viability in carbon sequestration.

This research was conducted at the MAD Lab in Saskatoon, Saskatchewan, and funded through the AGGP. Any questions regarding the findings of this report should be directed to:

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