Analysis of Karen Harper's cores from Churchill, Manitoba

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Abstract

During 2009, 14 black spruce (*Picea mariana*) trees were re-cored as part of a follow up project to a PhD's study from 2002 in Churchill, Manitoba. Trees were cored at the diameter at breast height (DBH) and 10 cm above ground (base). Samples were sent to the Mount Allison Dendrochonology Laboratory (MAD Lab) to acquire ring widths for the past seven years. Samples were given the MAD Lab code (09AML100), measured and then cross-dated to each other. Cores had a high level of correlation between them at both DBH (0.464) and base (0.454). In the final analysis, out of 56 paths only 13 had end years due to broken and missing ends.

Introduction

As part of a follow up project to a PhD's work on treeline in Churchill, Manitoba, 14 black spruce (*Picea mariana*) trees were re-cored during the summer of 2009. The trees were originally cored during the summer of 2002. The purpose of the dendrochronology analysis was to look at the ring widths since 2002.

Methods

Samples were taken from Churchill, Manitoba during the summer of 2009. Fourteen trees were cored at both diameter above breast height (DBH) and 10 cm above the ground level. One core was taken through the tree at each of the locations at all 14 trees. All trees were black spruce and had previously been cored in 2002 during the work of a PhD project. Samples were sent to the Mount Allison Dendrochronology Lab (MAD Lab) and given a MAD Lab code of 09AML100.

A pre-assessment of the cores was taken before processing occurred. This assessment included recording the condition of the cores, presence of bark or end wood and if the cores were broken (see Appendix 1 and 2).

In the lab samples were first glued into slotted mounting boards, and then sanded with progressively finer sanding paper (80-400grit) to bring out the cellular structures and annual rings of the wood. Rings were counted and measured along the middle of each sample using a Velmex measuring system with an accuracy of 0.001mm. Measurement paths were run through the most structurally sound portions of the sample.

A time series of measurements from both the DBH and base cores were correlated to each other. Cross-dating is the practice of taking the pattern of growth from one sample and comparing it to that of another (Figure 1). To assist in the cross-dating procedure we used the statistical cross-dating program COFECHA (Holmes, 1986a). COFECHA uses correlation values to assist in accurately dating samples. Higher correlation values indicate that the chronology has similar patterns. Lower correlation values can indicate a variety of things such as ecological or climatic variation from the norm or that the sample is inaccurately dated.

Each of the chronologies was standardized to have a mean of one by using a negative exponential curve in the program ARSTAN (Holmes, 1986b). This standardization was completed to allow samples of different ages to be compared.

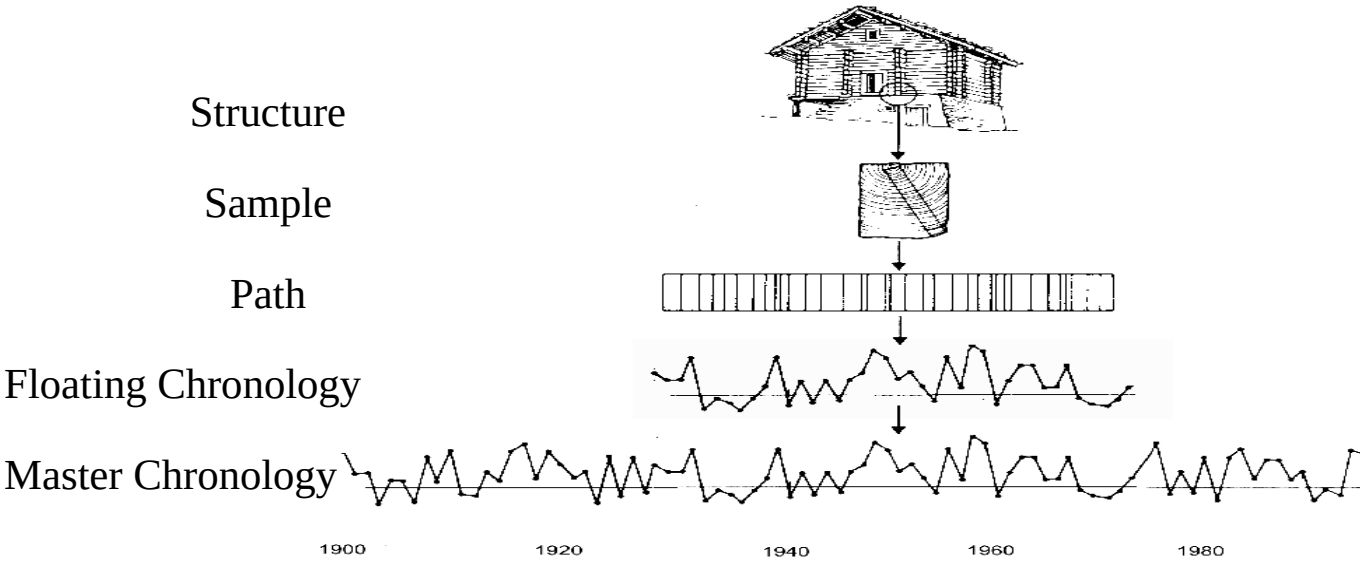

Figure 1 - Example of cross-dating by using patterns from a structure (floating chronology) compared to a master chronology.

Results and Discussion

Cores were divided in to two groups DBH and base. Twenty-six out of 28 paths from each group were cross-dated to each other. The cores were not in good shape and not all could be salvaged (see Appendix 1 and 2). A majority of the cores in both groups were missing their bark or end wood.

The DBH group had an interseries correlation of 0.464 with cores running from 1855-2009 and an average core length of 87.2 years (Table 1). Only 5 out of the 28 paths had end wood. The base group had an interseries correlation of 0.454 with cores aging between 1848 – 2009 and an average core length of 100.8 years (Table 1). Eight out of the 28 paths had end wood.

The correlation between the two groups is 0.555 (Figure 2A). This high correlation value makes sense due to the cores coming from the same set of trees. The number of samples peaks in the 1950's and then drops towards the past due to samples not being that old and to the present due to many samples having broken ends (Figure 2B).

Table 1 – Sample identifier, path, interval, number of year, presence of end wood, and correlation for both the DBH and BASE group. Codes from Karen Harper are also present.

		DBH				BASE				
Sample	**Path**	**Interval**	**# of years**	**End Wood**	**Correlation**	**Interval**	**# of years**	**End Wood**	**Correlation**	**Karen Harper #**
09AML001	A	1914-2001	88		0.619	1929-1996	71		0.641	464
09AML001	B	N/A	N/A	N/A	N/A	1911-2008	98	yes	0.407	
09AML002	A	1923-1968	46		0.367	1899-1989	93		0.371	469
09AML002	B	1923-1984	62		0.553	1899-2008	110	yes	0.376	
09AML003	A	1920-1984	65		0.664	1904-1990	87		0.410	476
09AML003	B	1920-2008	89	yes	0.368	1906-2008	103	yes	0.632	
09AML004	A	1895-2001	107		0.407	1889-1984	96		0.568	470
09AML004	B	1895-1996	102		0.388	1920-2002	83		0.326	
09AML005	A	1855-1956	102		0.342	1946-2004	59		0.373	480
09AML005	B	1855-1999	145		0.575	N/A	N/A	N/A	N/A	
09AML006	A	1952-2002	51		0.258	1902-2008	107	yes	0.648	481
09AML006	B	N/A	N/A	N/A	N/A	1903-1987	85		0.536	
09AML007	A	1876-1995	120		0.484	1868-2008	141	yes	0.525	482
09AML007	B	1876-2008	133	yes	0.479	1864-1958	95		0.113	
09AML008	A	1933-1988	56		0.517	1848-1989	142		0.313	570
09AML008	B	1933-2001	69		0.512	1850-2001	152		0.347	
09AML009	A	1942-2008	67	yes	0.473	1917-2006	90		0.704	592
09AML009	B	1942-2003	62		0.54	1917-2008	92	yes	0.579	
09AML010	A	1894-1989	96		0.249	1867-1975	109		0.408	605
09AML010	B	1894-2005	112		0.487	1867-1991	125		0.615	
09AML011	A	1905-1970	66		0.402	1897-1975	79		0.128	607
09AML011	B	1904-1981	78		0.241	1940-1996	57		0.365	
09AML012	A	1878-1984	107		0.418	1853-2001	149		0.415	608
09AML012	B	1878-2004	127		0.448	N/A	N/A	N/A	N/A	
09AML013	A	1910-2009	100	yes	0.612	1872-2008	137	yes	0.609	612
09AML013	B	1910-1984	75		0.653	1873-1984	112		0.446	
09AML014	A	1936-2008	73	yes	0.509	1932-2001	70		0.337	614
09AML014	B	1935-2004	70		0.479	1931-2009	79	yes	0.500	
		1855-2009	87.2	5	0.464	1848-2009	100.8	8	0.454	

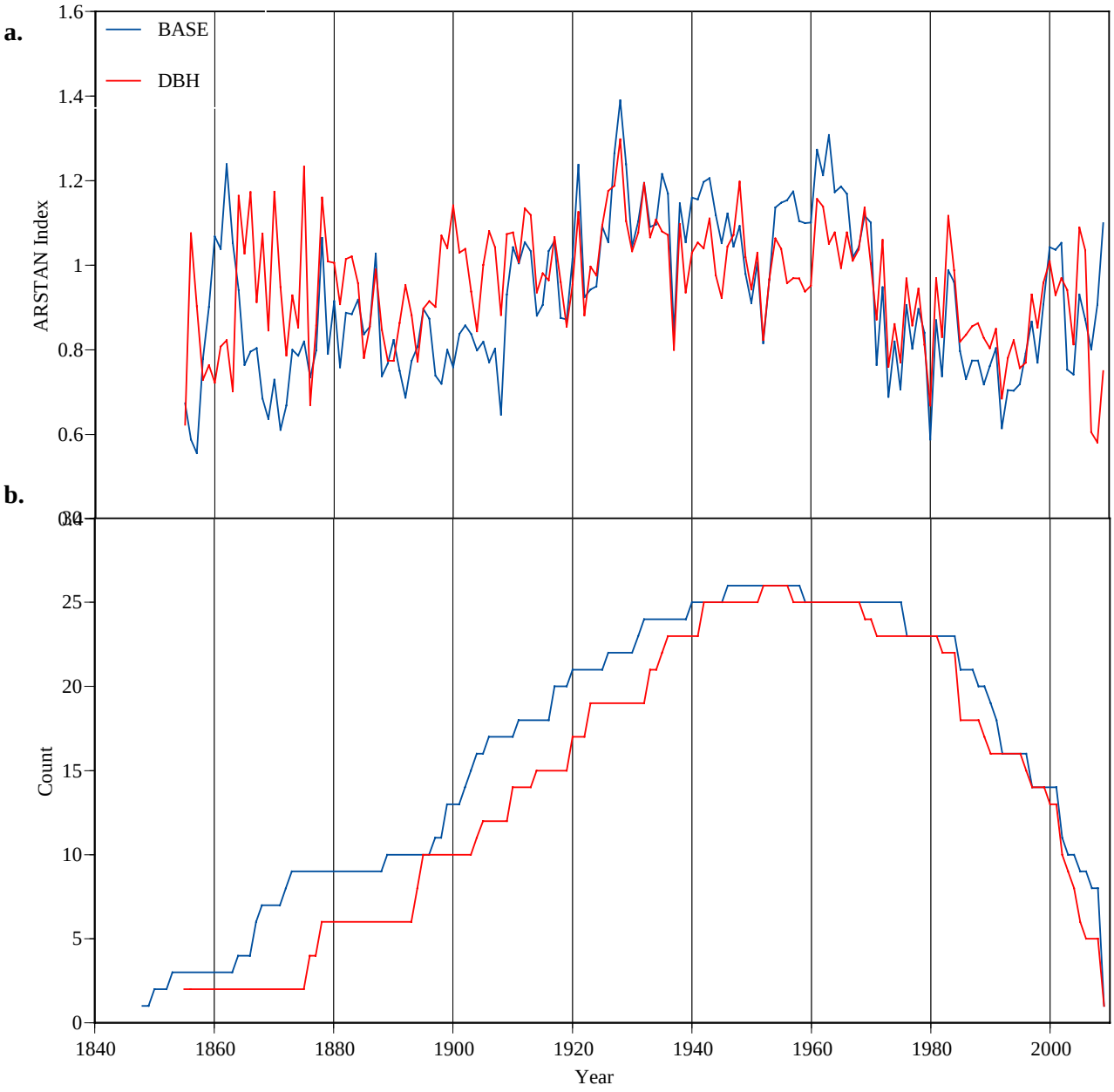

Figure 2a - The standardized chronologies for DBH and base samples. 2b - Sample length and depth for DBH and base chronologies.

Conclusions

The premise of this analysis was to collect ring width growth measurements that have occurred since 2002 on a set of 14 trees from Churchill, Manitoba. Most of the cores however, are missing the end wood from the core, thus missing the desired data.

References

Holmes, R.L. (1986a). Users manual for program COFECHA. In *Tree-ring chronologies of western North America: California, eastern Oregon, and northern Great Basin* (eds R.L. Holmes, R.K. Adams & H.C. Fritts), pp. 41-49. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Holmes, R.L., Adams, R.K., & Fritts, H.C. (1986b) Users Manual for Program ARSTAN. In *Tree-ring chronologies of western North America: California, eastern Oregon, and northern Great Basin* (eds R.L. Holmes, R.K. Adams & H.C. Fritts), pp. 50-65. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Appendix 1. Pre-assessment of cores, sample, location, bark, end wood, broken, Karen Harper sample number.

Sample	BASE/DBH	Bark	End Wood	Broken	Karen Harper #
09AML001	Base	no	yes	yes	464
09AML001	DBH	no	no	yes	
09AML002	Base	yes	yes	yes	469
09AML002	DBH	no	yes	no	
09AML003	Base	no	yes	no	476
09AML003	DBH	no	yes	no	
09AML004	Base	no	no	yes	470
09AML004	DBH	no	no	yes	
09AML005	Base	no	no	yes	480
09AML005	DBH	no	maybe	no	
09AML006	Base	no	yes	no	481
09AML006	DBH	no	yes	no	
09AML007	Base	no	yes	no	482
09AML007	DBH	no	maybe	no	
09AML008	Base	no	no	yes	570
09AML008	DBH	no	yes	no	
09AML009	Base	no	yes	no	592
09AML009	DBH	no	yes	no	
09AML010	Base	no	yes	no	605
09AML010	DBH	yes	yes	yes	
09AML011	Base	yes	yes	no	607
09AML011	DBH	no	no	yes	
09AML012	Base	no	yes	no	608
09AML012	DBH	yes	yes	no	
09AML013	Base	no	maybe	no	612
09AML013	DBH	no	yes	no	
09AML014	Base	no	yes	no	614
09AML014	DBH	yes	yes	yes	


09AML107 base 482
09AML107 DBH 482
09AML108 base 570
09AML108 DBH 570
09AML109 base 592
09AML109 DBH 592
09AML110 base 605
09AML110 DBH 605
09AML111 base 607
09AML111 DBH 607
09AML112 base 608
09AML112 DBH 608
09AML113 base 612
09AML113 DBH 612
09AML114 base 614
09AML114 DBH 614
09AML1001 base 464
09AML1001 DBH 464
09AML1002 base 469
09AML1002 DBH 469
09AML103 base 476
09AML103 DBH 476
09AML104 base 470
09AML104 DBH 470
09AML105 base 480
09AML105 DBH 480
09AML106 base 481
09AML106 DBH 481
09AML111 base 607
09AML111 DBH 607
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