Dendrochronological dating of the Kent Watershed

Amanda B. Young, Peter Nishimura and Colin P. Laroque

MAD Lab Report 2009-07

Mount Allison Dendrochronology Laboratory
Department of Geography and Environment
Mount Allison University

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Contents

Abstract

The Kent Watershed Coalition conducted a study in the Kent Region of New Brunswick, and collected 14 tree cores from five species (red maple (*Acer rubrum* L.), eastern white cedar (*Thuja occidentalis* L.), balsam fir (*Abies balsamea* (L.) Mill.), trembling aspen (*Populus tremuloides* Michx.), and spruce (*Picea sp.*)) of roughly the same Diameter Breast Height (DBH). Samples were sent to the Mount Allison Dendrochonology Laboratory (MAD Lab) to determine the age of the samples. Samples were given the MAD Lab code (09DL000), measured and cross-dated to nearby stands of similar species. The stand of trees sampled by the Kent Watershed Coalition identified growth in two phases: firstly, beginning in the 1930-40s and, secondly, during the 1970-80s.

Introduction

The Kent Watershed Coalition in Cocagne, New Brunswick has been conducting a forest study in the Kent Watershed. Fourteen cores from five species (red maple (*Acer rubrum* L.), eastern white cedar (*Thuja occidentalis* L.), balsam fir (*Abies balsamea* (L.) Mill.), trembling aspen (*Populus tremuloides* Michx.), and spruce (*Picea sp.*)) were taken from trees of the approximate same DBH. The samples were sent to the Mount Allison Dendrochronology Laboratory (MAD Lab) for dendrochronological dating of the trees. Dendrochronology is a field that uses patterns in the annual growth rings of trees to establish a chronology against which samples can be compared and subsequently dated.

Methodology

Samples were mounted to slotted boards and 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 from the center of each core using a Velmex measuring system with an accuracy of 0.001mm. A number of the samples were broken near the last few years of growth, preventing accurate measurement and dating (see Appendix A).

The floating chronologies from the samples were then cross-dated to previously-established master chronologies of each species in the area. Cross-dating is the practice of taking the pattern of growth from one sample and comparing it to another (Figure 1). In this case we took the floating chronology from each path and matched its patterns to the previously developed master chronology using the statistical cross-dating program COFECHA (Holmes 1986). This program uses correlation values to assist in accurately dating samples. Higher correlation values indicate that the floating chronology corresponds better to the master chronology. 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.

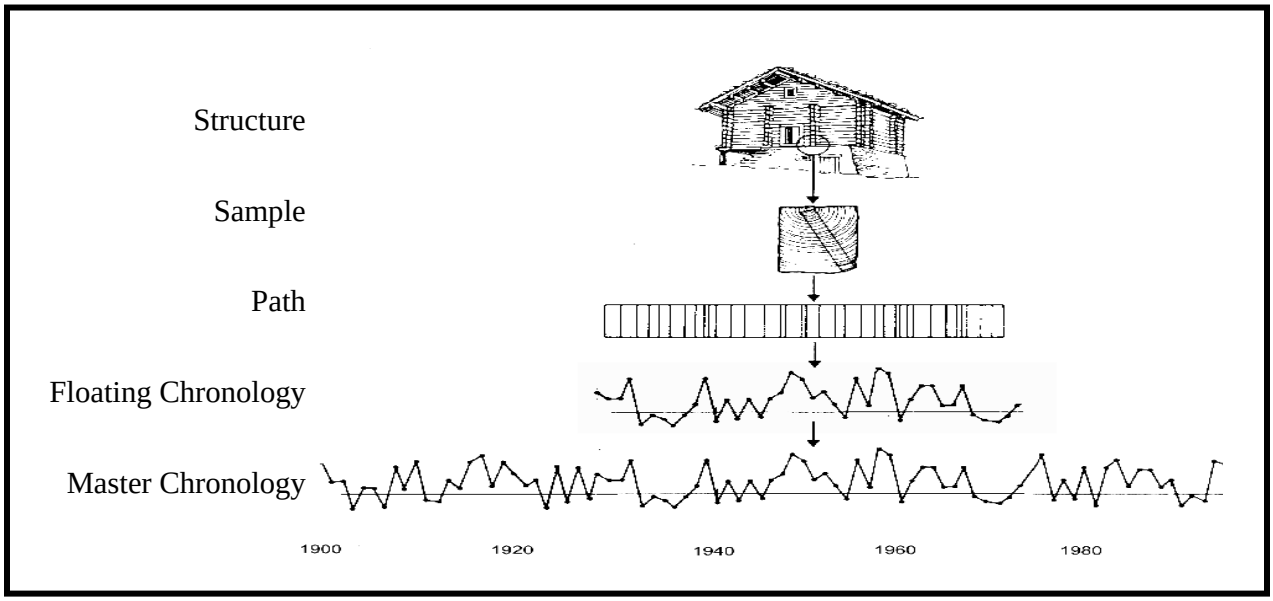

Figure 1. Example of cross-dating by using patterns from a structure (floating chronology) compared to the master chronology.

Results and Discussion

Of the five species analyzed in this study, only two demonstrated high intraspecies correlations, balsam fir and trembling aspen, meaning that samples within each chronology demonstrated a strong, unified growth signal. Both red maple and eastern white cedar illustrated poor intraspecies correlations. Sampled spruce consisted of only one sample, and so could not be evaluated for intraseries correlation. Though, these samples did not have good correlations with the same species at each site, they were able to be cross-dated against other existing chronologies created by the MADLAB. Red maple samples were cross-dated against a stand of sugar maple (*Acer saccharum* Marsh.) from northwest of Moncton, NB (07CTLE00) (Figure 2), eastern white cedar samples were cross-dated against a stand in Havelock, NB (04FL600) (Figure 3), balsam fir samples were cross-dated against a stand in Fundy National Park, NB (06AOL300) (Figure 4). The trembling aspen could not be cross-dated against an existing chronology, as one was not available. These samples, however, dated well against each other and were in good condition (Figure 5). The lone spruce sample was cross-dated against a black spruce stand located near New Cannan, NB (08DL100) (Figure 6).

There appear to be two periods of establishment from the submitted samples: firstly, in the 1930-40s and, secondly, in the 1970-80s (Table 1). Few of the cores reached the pith (center) of the tree (Appendix A). These data are based on ring counts, resulting in the calculation of the minimum age of trees rather than their actual age.

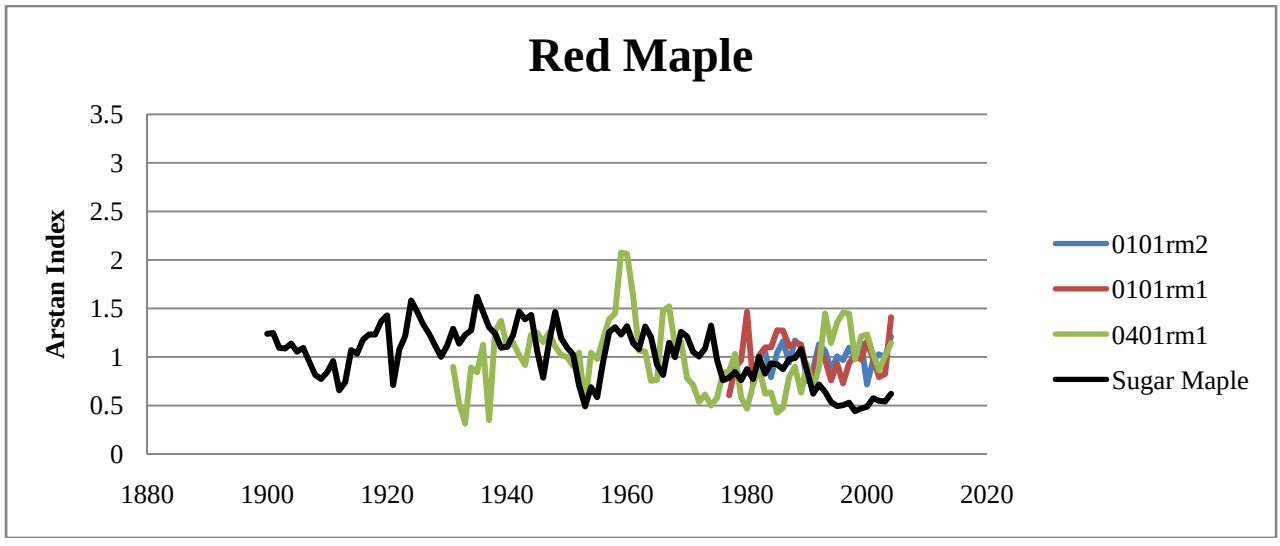

Figure 2. Red maple chronologies from the Kent Watershed compared with the sugar maple chronology from stand northwest of Moncton, NB.

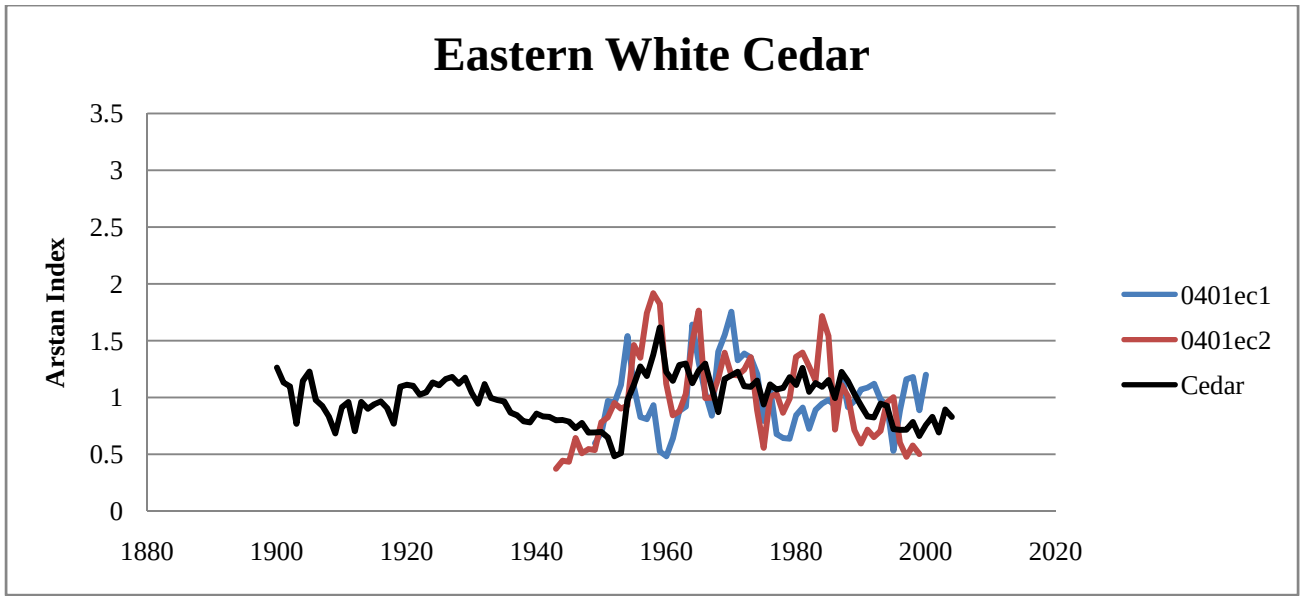

Figure 3. Eastern white cedar chronologies from the Kent Watershed compared with eastern white cedar chronology from Havelock, NB..

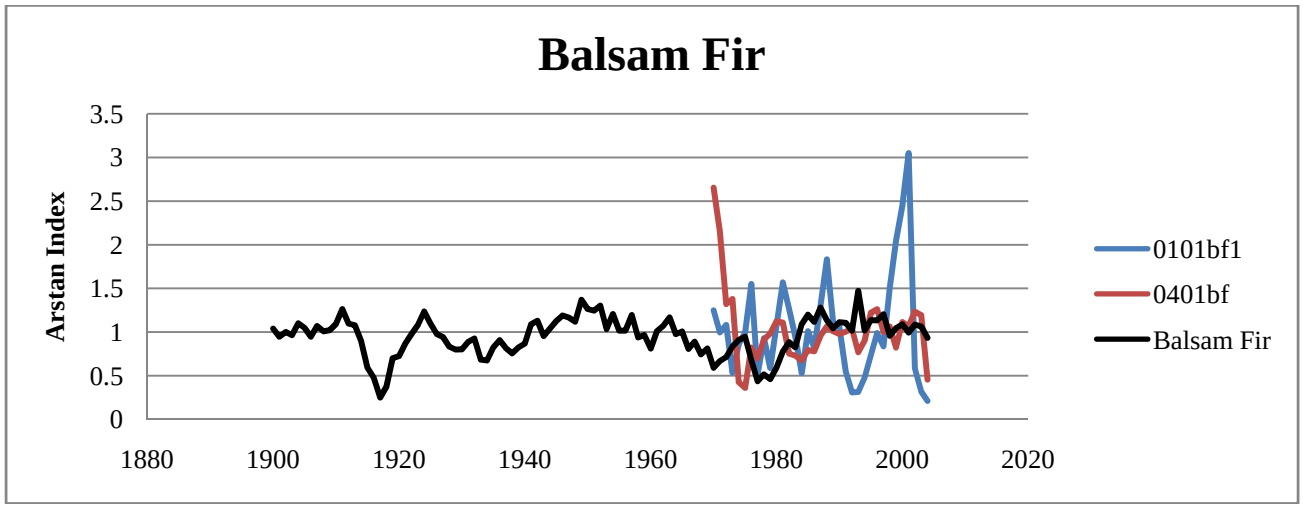

Figure 4. Balsam fir chronologies from the Kent Watershed compared with balsam fir chronology from Fundy National Park, NB.

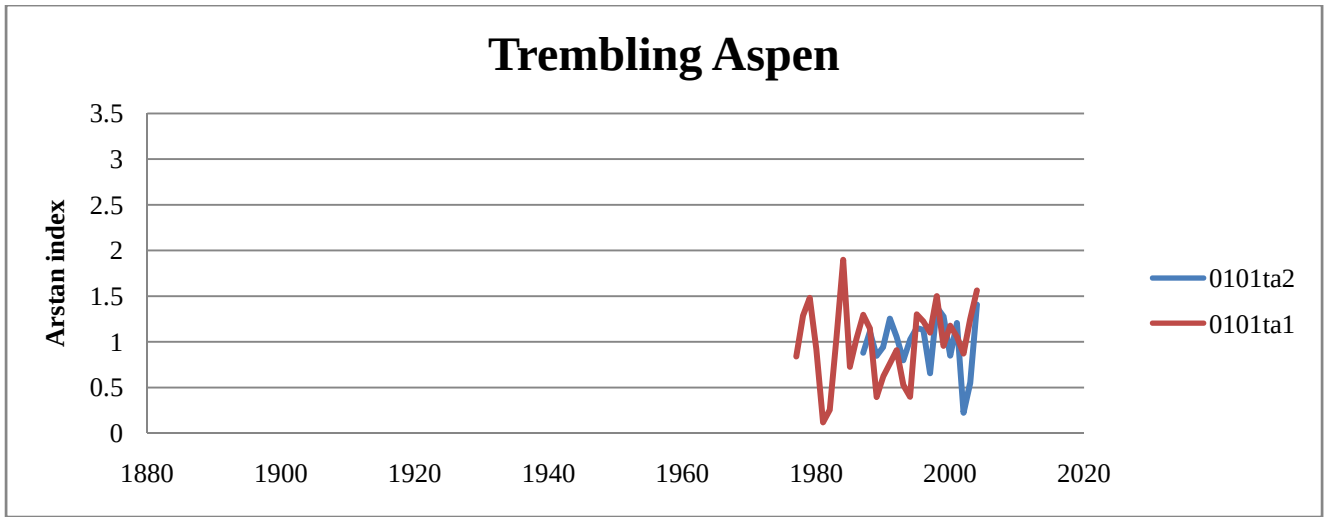

Figure 5. The trembling aspen series from the Kent Watershed.

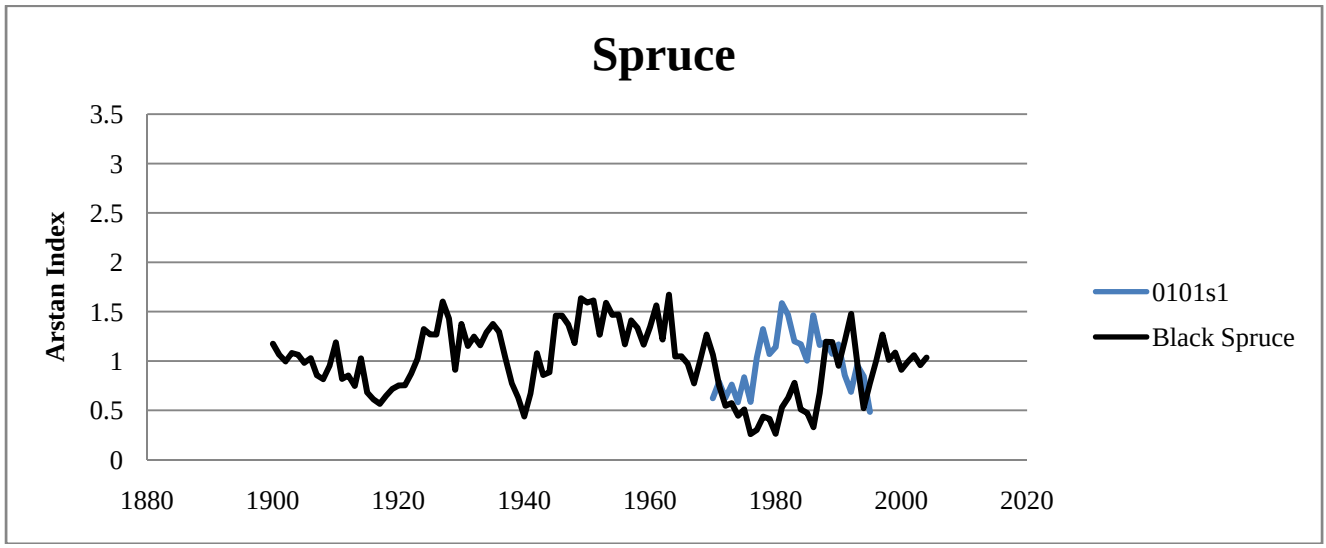

Figure 6. Spruce sample compared with a black spruce chronology from a stand near New Cannan, NB.

Species	Code	1st ring	Last ring	Years Cross-dated	# of rings	State of core
Red Maple	0101RM1	1977	2004	28	31	broken end
	0101RM2	1983	2005	23	25	broken end
	0401RM1	1931	2008	78	77	good sample
Eastern White Cedar	0401EC1	1949	2000	52	59	broken end
	0401EC2	1943	1999	57	65	broken end
Balsam Fir	0101BF1	1970	2006	37	38	broken end
	0401BF1	1970	2008	39	38	broken end
Trembling Aspen	0101TA1	1977	2007	22	31	good sample
	0101TA2	1987	2008	31	21	good sample
Spruce	0101S1	1970	1989	19	38	broken end

Table 1. Species, core code, first ring measured, last ring measured, # of years measured, age to inner most ring, and the state of the core.

Conclusions

The stand of trees sampled by the Kent Watershed Coalition established in two phases, one in the 1930-40s and then again during the 1970-80s. Dendrochronological analysis has revealed that, of the five different species sampled during this study, only balsam fir and trembling aspen demonstrated a strong, unified growth signal at the site. Cross-dating of red maple and eastern white cedar revealed poor interseries correlations.

References

Holmes, R.L. (1986). 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.

01 01 RM2
01 01 RM1
01 01 TA1
01 01 TA2
01 01 S1
01 01 BF1
04-01-EC2
04-01-RM1
04-01-BF1