Mad Lab Report 2006-24

A Dendrochronological Analysis of the Berwick Campground Hemlocks:
Berwick, Nova Scotia

By

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Abstract

Tree-ring sampling was conducted at the eastern hemlock (*Tsuga canadensis*) stand on the Berwick Campground in Berwick, Nova Scotia. The sampling was conducted in efforts to extend the Mount Allison Dendrochronology (MAD) Lab chronologies for southwestern Nova Scotia. Statistical analysis was conducted on the *T. canadensis* stand and the general growth pattern for the trees was extracted from ring-width measurements. The oldest tree sampled from the Berwick campground was 235 years old, while the youngest was only 99. Thirty-six of the forty cores taken illustrate the same growth pattern and so are probably all capturing the dominant environmental factors of the climate at the site.

Introduction

A dendrochronological analysis was conducted on the stand of hemlocks on the Berwick Campground in Berwick, Nova Scotia (Figure 1). This stand of trees was one of fifteen stands in southwestern Nova Scotia sampled in the summer of 2006 by the Mount Allison Dendrochronoogy Laboratory (MAD Lab). The purpose of this study was to extend tree-ring-width chronologies for the southwest region of Nova Scotia. Previous sampling in Nova Scotia had resulted in establishing an eastern hemlock (*Tsuga canadensis*) chronology that dated back to 1827. The stand at the Berwick Campground was targeted to extend *T. canadensis* chronologies further back in time.

Figure 1: Sampling conducted at the Berwick Camp.

Research Methods

Twenty mature hemlock trees at the Berwick Campground were selected to be sampled. From each tree, two cores were taken using an increment borer (Figure 2).

Figure 2: A core being removed from an increment borer. Note that the diameter of the core is about the size of a pencil (4.3 mm).

The samples were transported back to the MAD Lab and each of the forty cores were then glued into a slotted mounting board. The cores were sanded flat and polished to 600 grit. The cores were then scanned into a computer system at 800 dpi and a ring-width analysis was conducted using the WinDendro™ Image analyzing system. Tree cores that exhibited very small annual rings were measured using a Velmex system and a 63x light microscope system. These measurements revealed the growth patterns of each individual tree. Using statistical programs provided by the International Tree-Ring Data Bank, the growth patterns were crossdated to create a general growth pattern for the stand of trees as a whole.

Results and Discussion

The analysis of the hemlock cores taken from the Berwick Campground extended the chronology of *T. canadensis* in southwestern Nova Scotia back to 1777. Although 40 cores were originally taken, only 36 of the cores were used in the final analysis (Table 1). The oldest tree sampled from the Berwick campground was 235 years old. The youngest core displayed only 99 annual rings (Table 1).

Table 1: COFECHA output table displaying age, ring measurement data and correlations.

Seq	Series	Interval	Years	Corr with Master	Mean msmt	Max msmt
1	06SL801A	1791	2006	0.611	1.21	3.32
2	06SL801B	1770	2005	0.651	1.2	3.72
3	06SL802A	1799	2005	0.697	1.15	3.81
4	06SL802B	1798	2005	0.667	1.14	3.83
5	06SL803A	1780	2004	0.477	0.97	4.15
6	06SL803B	1856	2004	0.6	1.41	4.6
7	06SL804A	1791	2006	0.418	1.05	3.77
8	06SL804B	1802	2006	0.566	1.15	3.69
9	06SL805A	1852	2005	0.555	1.29	4.53
10	06SL805B	1795	2006	0.449	0.79	2.53
11	06SL806A	1774	2004	0.563	0.86	2.5
12	06SL806B	1852	2003	0.642	0.83	3.12
13	06SL807A	1785	2005	0.649	0.95	4.12
14	06SL807B	1781	2005	0.589	0.92	3.32
15	06SL808A	1814	2002	0.605	0.83	10.13
16	06SL808B	1857	2005	0.672	1.12	6.97
17	06SL810A	1870	2006	0.327	1.42	4.99
18	06SL810B	1844	2006	0.596	1.58	4.65
19	06SL811A	1839	2005	0.653	1.09	2.88
20	06SL811B	1859	2005	0.687	0.95	2.62
21	06SL812A	1783	2005	0.567	1.14	2.93
22	06SL812B	1782	2006	0.506	1.15	5.12
23	06SL813A	1825	2006	0.254	0.89	2.83
24	06SL813B	1794	2004	0.503	0.6	2.06
25	06SL814B	1906	2004	0.555	1.02	3.33
26	06SL815A	1788	2005	0.578	0.86	3
27	06SL815B	1774	2004	0.573	0.9	2.74
28	06SL816A	1795	2005	0.543	1.04	3.04
29	06SL816B	1784	2004	0.484	0.94	2.85
30	06SL817A	1794	2005	0.648	0.85	2.3
31	06SL817B	1792	2002	0.56	0.99	2.69
32	06SL818A	1801	2006	0.413	0.89	2.99
33	06SL818B	1874	2005	0.682	1.68	7.59
34	06SL819A	1810	2005	0.596	1.02	3.49
35	06SL820A	1794	2005	0.271	1.17	3.2
36	06SL820B	1814	2005	0.505	1.02	2.84
			Mean	0.551	1.04	10.13

The statistical analysis of the stand's growth patterns revealed that the trees were all responding to the environment similarly, as the COFECHA correlation coefficient of 0.551 (based on 50 year segments) was very strong (Note: all values above 0.3281 are significant at the 99% interval).

The average annual growth of the stand was relatively small at 1.04 mm per year; this rate of slow growth has probably contributed to the longevity of the stand. The radial growth of the past few years (2002-2006) illustrates that the stand has exhibited higher than average growth (Figure 3). This suggests that the Berwick Campground hemlock stand is continuing to grow healthily.

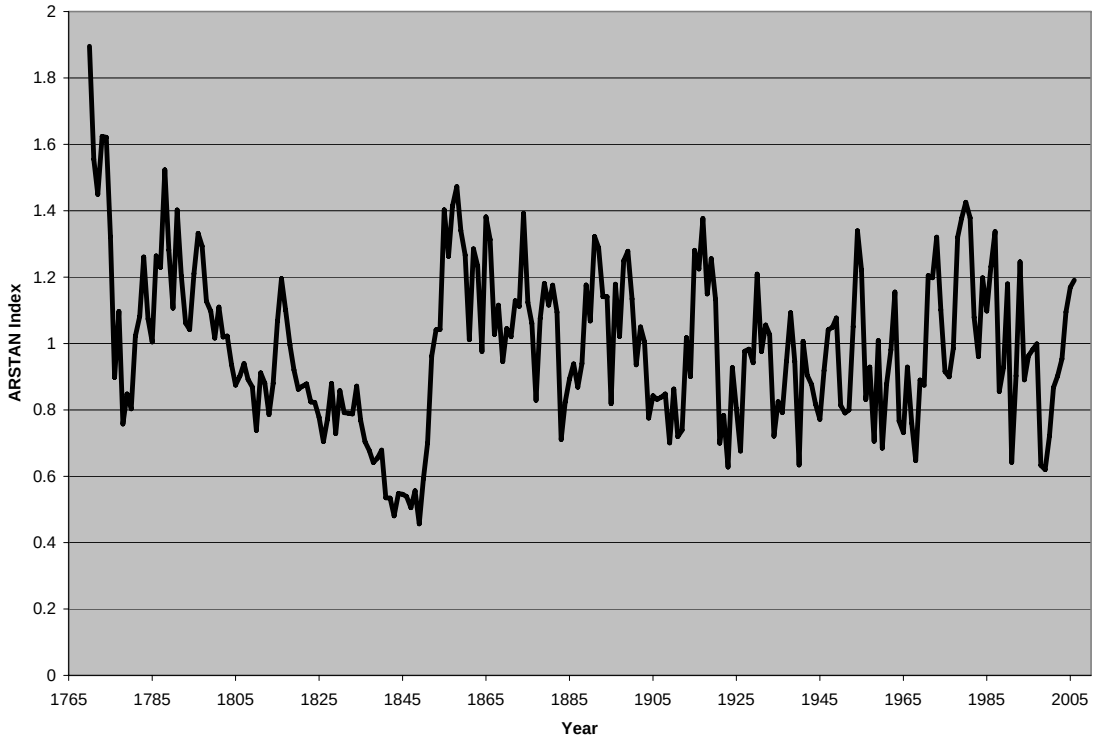

Figure 3: The crossdated growth pattern of the Berwick Campground hemlock stand. Note that the further back in time, the smaller the sample depth and thus the lower the confidence that can be placed in the growth record. Average growth is demarcated on the y-axis by an ARSTAN Index of 1.0.

Conclusion

The stand of eastern hemlock at the Berwick Campground extended the MAD Lab hemlock chronology for southwestern Nova Scotia back 50 year further than anywhere else in the region. The data that was provided by the site will go a long way in providing an extended time frame in which the past environmental conditions can be compared to present day conditions. In this manner, alterations in the climates from past environments to our present environments, can be searched for in rings of the Berwick trees. These changes to the environment can not presently be found in the instrumental data captured by humans, but perhaps they have been readily saved in the rings of each tree.