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Tree ring dating of an Eastern Hemlock stump from Belfast, PEI

By

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ABSTRACT

An Eastern hemlock (*Tsuga canadensis*) tree stump was delivered to the MAD Lab by Bill Glen from the Department of Environment , Energy and Forestry in PEI.. The tree was believed to have been cut down in 1982. The stump sample was already surfaced and a shellac coating had been applied to the disc. Ring measurements indicate that tree growth expressed classic suppressed growth early in life, until radial growth was released, when the tree probably achieved a dominant canopy position. Although no other ring measurement patterns for Eastern hemlock could be found from Prince Edward Island, the single sample exhibits regional similarity to Eastern hemlock patterns from nearby samples in New Brunswick and Nova Scotia available from the MAD Lab archives. The sample is believed to be the oldest archived Eastern hemlock sample from Price Edward Island, and is currently one of the oldest in the Maritimes.

INTRODUCTION

The Mount Allison Dendrochronology Lab (MAD Lab) was contacted to process a tree stump that was collected by the Department of Environment, Energy and Forestry in Prince Edward Island. The sample came from a location near Belfast, PEI (Lat. 46.0896897 N, Long. 62.8564407 W), east of Charlottetown. The tree was reported to be one of the largest and most sound Eastern hemlock (*Tsuga canadensis*) samples known to have come from Prince Edward Island. For this reason and because the species is of great interest to the forestry community, more information was sought about the sample.

The MAD Lab processed the sample using standard dendrochronological methods to determine the age and ring measurements for the sample. The process was broken into three steps, 1) scanning the sample, 2) extracting a ring pattern of radial growth for the sample, and 3) pattern matching (crossdating) the sample's ring record against existing base chronologies for the region.

SAMPLE PREPARATION AND ANALYSIS

The large sample arrived at the MAD Lab from the Department of Environment, Energy and Forestry in Prince Edward Island, and was assigned the MAD Lab sample number 06AA002. The sample was of sufficient size that scanning a high-resolution image proved tricky. Although the sample was in great condition, the size of the sample made for interesting lab procedures.

To prepare the sample for ring measurement, the disc was inverted and scanned in three sections on a large-area high-resolution flat bed scanner. A high resolution image was needed as the shellacking process made reading the rings in tight areas more difficult than if the sample could be polished and scanned when the wood sample was in direct contact with the scanner bed. Because of the shear size and weight of the disk sample, six people were needed to invert the disc and hold it on top of scanner. Once the three areas were scanned, the images were digitally joined in Photoshop to create one image that encompassed from pith to bark of the sample.

RING MEASUREMENTS

The digital image was brought into the program WinDendro™ and an analysis was conducted. Although the WinDendro™ system is capably of measurements up to 0.001 mm, the extra step of developing the complied digital image probably limits ring measurement resolution to 0.01 mm. Even with this slight loss of resolution, the rings are so relatively large, that any margin of error would be very small.

Two paths were measured and pattern matched with each other to determine if the ring widths were showing the same general configuration within the sample. The analysis established that they were almost nearly identical and so average measurements were created for each year. The sample was then deemed robust enough to attempt crossdating with a living chronology if one could be found from within the region. An end date of 1982 was given to the series of measurements.

RESULTS

Figure 1 displays the results of the measurement analysis. Growth is typical of a tree growing under a canopy, where annual increments are small early in life. Apical growth on the stump sample initiated in 1671 with small rings being produced in the early years of the trees life. As the tree aged, it began to attain a more prominent place within the canopy and the increased light levels added a significant amount of radial-growth increment to the tree. During the last stage of the trees life, radial growth began to become more reduced, which would be typical for trees of this age. The tree was cut in 1982 while it was still experiencing relatively good incremental growth.

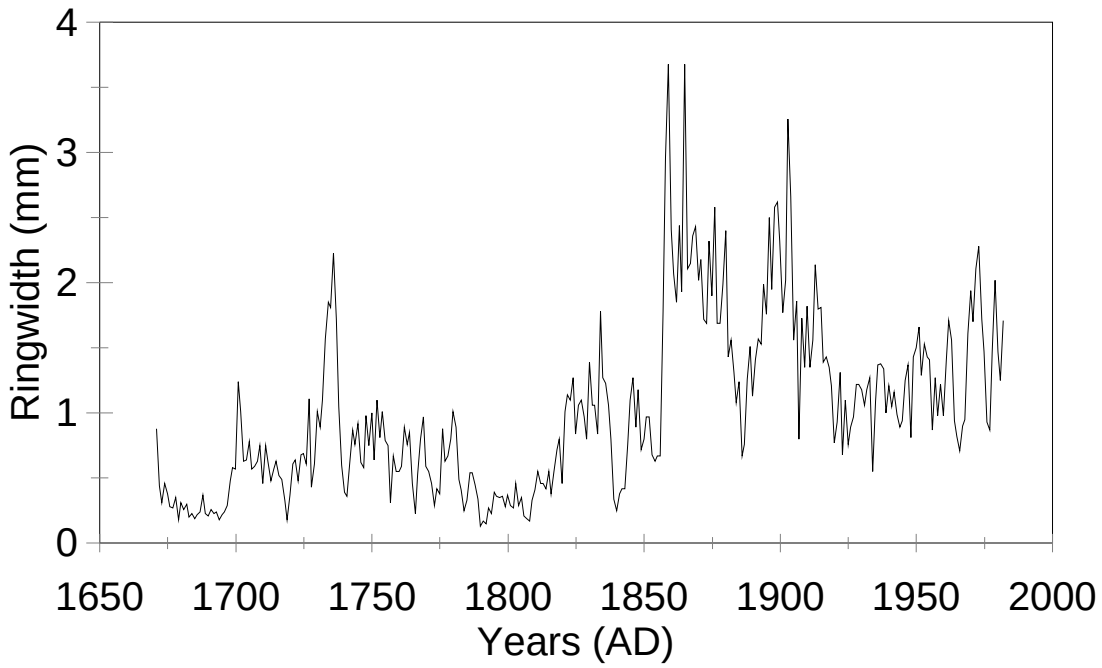

Figure 1 - Ring measurements of MAD Lab sample 06AA002, a series of Eastern hemlock data from Belfast, PEI. The series spans a time frame from 1671 to1982.

Cross-dating

Although a search of databases that may have contained growing records of other Eastern hemlock in PEI was conducted, no chronologies were found. At this time, the sample provides the first recorded growth record and until such time that others samples can be found, the data will be archived in the MAD Lab to wait until it may be used in the future.

Although no other samples were found in PEI, two master chronologies from adjacent provinces were used as quality checking of the samples. A set of Eastern hemlock was used from Mount Zackie Jonah (MAD Lab series 06AL800) in New Brunswick, and a set of hemlock from Horse

Lake (MAD Lab series 04AGL800) near Kejimkujic National Park. The data are graphed in Figure 2 and all three show great similarity even though the PEI trend is only made up of one tree.

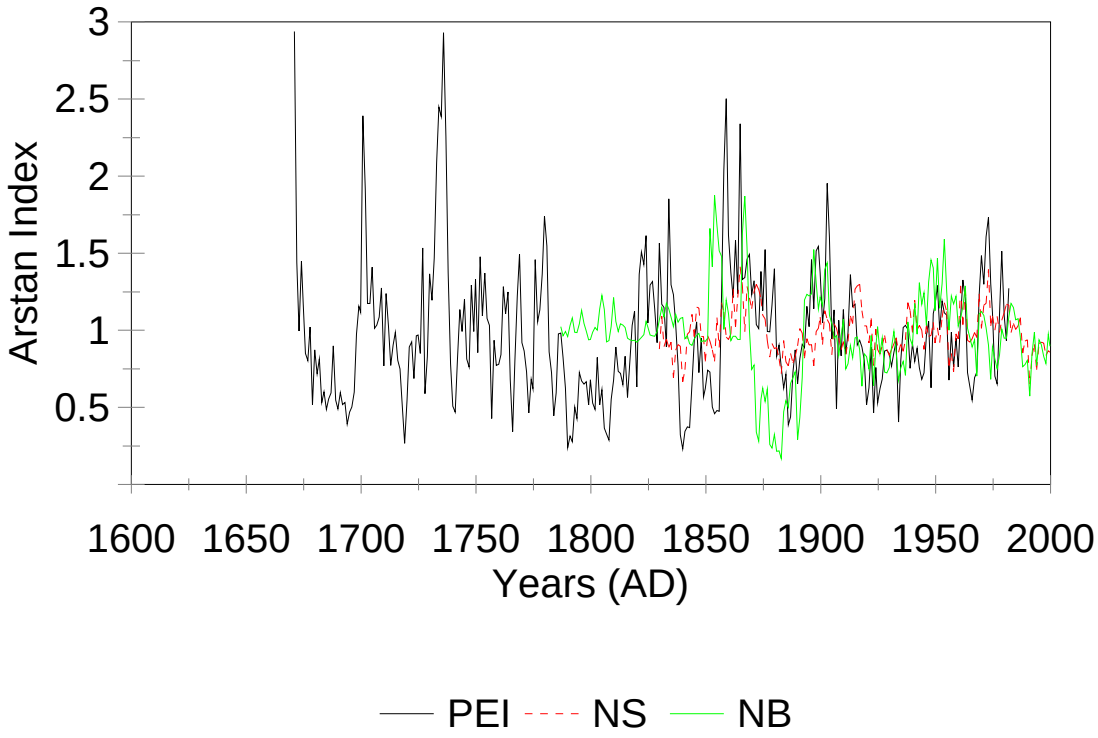

Figure 2 - ARSTAN Indices of Eastern hemlock ring measurements from PEI, NS, and NB. The PEI hemlock data from Belfast is only one tree while the other two ring measurements are from a series of cores. Good agreement between the three series is seen, especially within the last 100 years.

CONCLUSION

Although no other ring measurement patterns for Eastern hemlock could be found in PEI, it is believed that no missing rings are present in the sample because the sample could be compared to data from Nova Scotia and New Brunswick. Because this comparison is possible, it also signifies that over-riding factors controlling growth are similar at all three sites. Since the locations of the sampling sites are hundreds of kilometres apart, micro-site characteristics are not enough to separate the growing regime of each species. In fact the only external factor that can account for the similarity in growth at all three sites is regional climate.

APPENDIX A

Raw ring measurements in mm.

Eastern Hemlock		1713	0.48	1756	0.75	1799	0.28	1842	0.42
1671	0.88	1714	0.57	1757	0.31	1800	0.37	1843	0.42
1672	0.44	1715	0.63	1758	0.67	1801	0.29	1844	0.76
1673	0.31	1716	0.52	1759	0.55	1802	0.27	1845	1.10
1674	0.46	1717	0.49	1760	0.55	1803	0.46	1846	1.27
1675	0.38	1718	0.33	1761	0.59	1804	0.29	1847	0.89
1676	0.28	1719	0.18	1762	0.89	1805	0.35	1848	1.18
1677	0.27	1720	0.37	1763	0.76	1806	0.21	1849	0.72
1678	0.35	1721	0.61	1764	0.85	1807	0.19	1850	0.80
1679	0.18	1722	0.64	1765	0.46	1808	0.17	1851	0.97
1680	0.31	1723	0.48	1766	0.23	1809	0.33	1852	0.97
1681	0.26	1724	0.68	1767	0.53	1810	0.41	1853	0.68
1682	0.30	1725	0.69	1768	0.80	1811	0.55	1854	0.63
1683	0.20	1726	0.61	1769	0.97	1812	0.46	1855	0.67
1684	0.23	1727	1.11	1770	0.59	1813	0.46	1856	0.67
1685	0.19	1728	0.43	1771	0.55	1814	0.42	1857	1.78
1686	0.22	1729	0.61	1772	0.46	1815	0.55	1858	2.96
1687	0.24	1730	1.01	1773	0.29	1816	0.38	1859	3.68
1688	0.37	1731	0.89	1774	0.42	1817	0.55	1860	2.41
1689	0.23	1732	1.10	1775	0.38	1818	0.72	1861	2.07
1690	0.21	1733	1.57	1776	0.88	1819	0.80	1862	1.85
1691	0.26	1734	1.85	1777	0.63	1820	0.46	1863	2.44
1692	0.23	1735	1.81	1778	0.67	1821	1.01	1864	1.93
1693	0.24	1736	2.23	1779	0.80	1822	1.14	1865	3.68
1694	0.18	1737	1.72	1780	1.01	1823	1.10	1866	2.11
1695	0.22	1738	1.05	1781	0.89	1824	1.27	1867	2.15
1696	0.24	1739	0.60	1782	0.49	1825	0.84	1868	2.36
1697	0.29	1740	0.39	1783	0.41	1826	1.06	1869	2.43
1698	0.48	1741	0.36	1784	0.25	1827	1.10	1870	2.02
1699	0.58	1742	0.62	1785	0.33	1828	0.97	1871	2.18
1700	0.57	1743	0.87	1786	0.54	1829	0.80	1872	1.72
1701	1.24	1744	0.76	1787	0.54	1830	1.39	1873	1.69
1702	1.01	1745	0.92	1788	0.45	1831	1.06	1874	2.32
1703	0.63	1746	0.62	1789	0.34	1832	1.06	1875	1.90
1704	0.64	1747	0.58	1790	0.13	1833	0.84	1876	2.58
1705	0.78	1748	0.98	1791	0.17	1834	1.78	1877	1.69
1706	0.57	1749	0.75	1792	0.15	1835	1.27	1878	1.69
1707	0.59	1750	1.00	1793	0.27	1836	1.23	1879	1.99
1708	0.63	1751	0.64	1794	0.23	1837	1.06	1880	2.40
1709	0.75	1752	1.10	1795	0.39	1838	0.80	1881	1.43
1710	0.46	1753	0.81	1796	0.36	1839	0.34	1882	1.56
1711	0.75	1754	1.01	1797	0.35	1840	0.25	1883	1.31
1712	0.63	1755	0.79	1798	0.36	1841	0.38	1884	1.08

1885	1.24	1931	1.06	1977	0.87
1886	0.67	1932	1.18	1978	1.47
1887	0.76	1933	1.27	1979	2.02
1888	1.26	1934	0.55	1980	1.47
1889	1.51	1935	1.09	1981	1.25
1890	1.13	1936	1.37	1982	1.71
1891	1.41	1937	1.38		
1892	1.57	1938	1.34		
1893	1.53	1939	1.00		
1894	1.99	1940	1.21		
1895	1.76	1941	1.05		
1896	2.50	1942	1.16		
1897	1.95	1943	0.99		
1898	2.58	1944	0.89		
1899	2.62	1945	0.94		
1900	2.32	1946	1.25		
1901	1.77	1947	1.37		
1902	2.02	1948	0.81		
1903	3.26	1949	1.43		
1904	2.66	1950	1.50		
1905	1.56	1951	1.66		
1906	1.86	1952	1.29		
1907	0.80	1953	1.53		
1908	1.73	1954	1.43		
1909	1.35	1955	1.41		
1910	1.82	1956	0.87		
1911	1.35	1957	1.27		
1912	1.56	1958	0.98		
1913	2.14	1959	1.22		
1914	1.80	1960	0.98		
1915	1.81	1961	1.40		
1916	1.39	1962	1.71		
1917	1.43	1963	1.56		
1918	1.35	1964	0.94		
1919	1.21	1965	0.82		
1920	0.77	1966	0.71		
1921	0.93	1967	0.90		
1922	1.31	1968	0.95		
1923	0.68	1969	1.61		
1924	1.10	1970	1.94		
1925	0.76	1971	1.70		
1926	0.89	1972	2.11		
1927	0.97	1973	2.28		
1928	1.22	1974	1.72		
1929	1.22	1975	1.47		
1930	1.18	1976	0.93		