Crossdating Mersey-Tobeatic Ring Measurements

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Abstract

As part of the overall analysis on a Mersey-Tobeatic research project, the MAD Lab was contacted to assist in crossdating and graphing the results of measurement procedures conducted by Katie Nickerson. The results indicate that all of the data correlates significantly (0.344 using 50-year increments). The data were then standardized and are represented in a Master Chronology for the region from 1756-2006.

Introduction

To help illustrate a group of measurements from tree rings collected and processed by Katie Nickerson of the Mersey Tobeatic Research Institute, spreadsheet data was sent to the MAD Lab to crossdate, standardize and graph to help illustrate the data. Normal procedures were conducted on the data as explained below.

Methods

Raw measurement data were condensed into a Windendro spreadsheet format and then program Convert 1.3 was used to move this data into the standardized Tucson Decadal format. The decadal format was needed as it is the input format for all other International Tree Rig Data Base software. The data were checked for signal homogeneity (crossdating or pattern matching) by statistically analyzing them in program COFECHA.

COFECHA uses a Pearson's correlation procedure to relate how well each individual core relates to the overall group, which is made up of all cores present in a series. All cores which correlate to the group at a value higher level than 0.3281 are considered to be similar enough to pass the 99% confidence interval.

Once the series of cores were deemed to be illustrating a common signal, program ARSTAN was used to detrend (remove the biological growth trend) each of the individual cores and then average all of the cores together into a master chronology for the project.

All of the raw measurement data and the standardized master chronology was complied into a spreadsheet file and this file will be presented along with this report.

Results

The results of the crossdating procedure are listed in Table 1. In general of the 38 cores submitted for the analysis most fit an overall general pattern. This is perhaps surprising since the data represent multiple species. With many of the individual trees representing close ties with the Master, the vast majority must be one species. Individuals which stand out as probable outliers are D0101-C, D0102-C, V0301-A, M0202-A, and H0202-A, based on their very low correlations with the master, and their high individual segments with flags numbers.

Table 1 – A crossdating COFECHA summary table for the data in this project.

Number	Series	Interval	No. Years	No. 50-yr Segment	Segments with Flags	Correlation with Master
1	D0101-A	1874 2006	133	6	3	0.474
2	D0102-A	1871 2006	136	6	3	0.343
3	D0201-A	1929 2006	78	3	0	0.454
4	D0202-A	1930 2006	77	3	0	0.430
5	D0102-B	1849 2006	158	7	2	0.452
6	D0301-B	1884 2006	123	5	0	0.539

7	D0201-B	1885 2006	122	5	2	0.498
8	D0101-C	1768 2006	239	10	8	0.145
9	D0201-C	1756 1999	244	9	7	0.157
10	D0202-C	1838 2006	169	7	4	0.330
11	D0301-C	1789 2006	218	9	6	0.202
12	D0301-D	1915 2006	92	4	0	0.465
13	D0302-D	1922 2006	85	4	0	0.478
14	D0201-E	1930 2006	77	3	3	0.053
15	C0101-A	1898 2006	109	5	5	0.274
16	C0102-A	1949 2006	58	3	1	0.348
17	C0201-A	1913 2006	94	4	0	0.480
18	C0202-A	1880 2006	127	5	2	0.272
19	G0202-A	1909 1999	91	3	1	0.236
20	V0102-A	1913 2006	94	4	1	0.330
21	V0201-A	1930 2006	77	3	1	0.358
22	V0301-A	1926 2003	78	3	3	0.217
23	V0202-A	1926 2006	81	3	0	0.513
24	V0302-A	1922 2006	85	4	2	0.317
25	V0101-B	1913 1998	86	3	0	0.491
26	V0102-B	1890 2006	117	5	3	0.257
27	L0101-A	1911 2006	96	4	0	0.695
28	L0102-A	1930 2006	77	3	0	0.663
29	L0202-A	1818 2004	187	8	4	0.305
30	L0301-A	1874 2006	133	6	1	0.480
31	L0302-A	1901 2006	106	4	4	0.216
32	C0101-A	1902 2006	105	4	1	0.488
33	C0102-A	1864 2006	143	6	2	0.386
34	M0202-A	1899 2001	103	5	5	0.154
35	H0101-A	1921 2003	83	4	3	0.272
36	H0102-A	1886 2006	121	5	0	0.381
37	H0201-A	1895 2006	112	5	0	0.500
38	H0202-A	1896 2006	111	5	5	0.067
	Total or mean		4425	185	82	0.344

The overall growth pattern of the group was attained by standardizing each series with a single detrending of either a negative exponential curve, a straight line through the data, or a cubic smoothing spline. The result of the analysis is illustrated in Figure 1.0.

Data files for the procedures are saved in the below files. Decadal data is saved in file [Katie.txt], while the raw measurement are listed in 2 column format (year, value) and are in the first tab of the spreadsheet [Katie.xls]. From this format, any individual or combination of core(s) can easily be graphed as an xy graph. An example is given in Figure 2.0. The second tab of the spreadsheet contains the standardized ARSTAN index in the same format which might also be used in various combinations of illustrations.

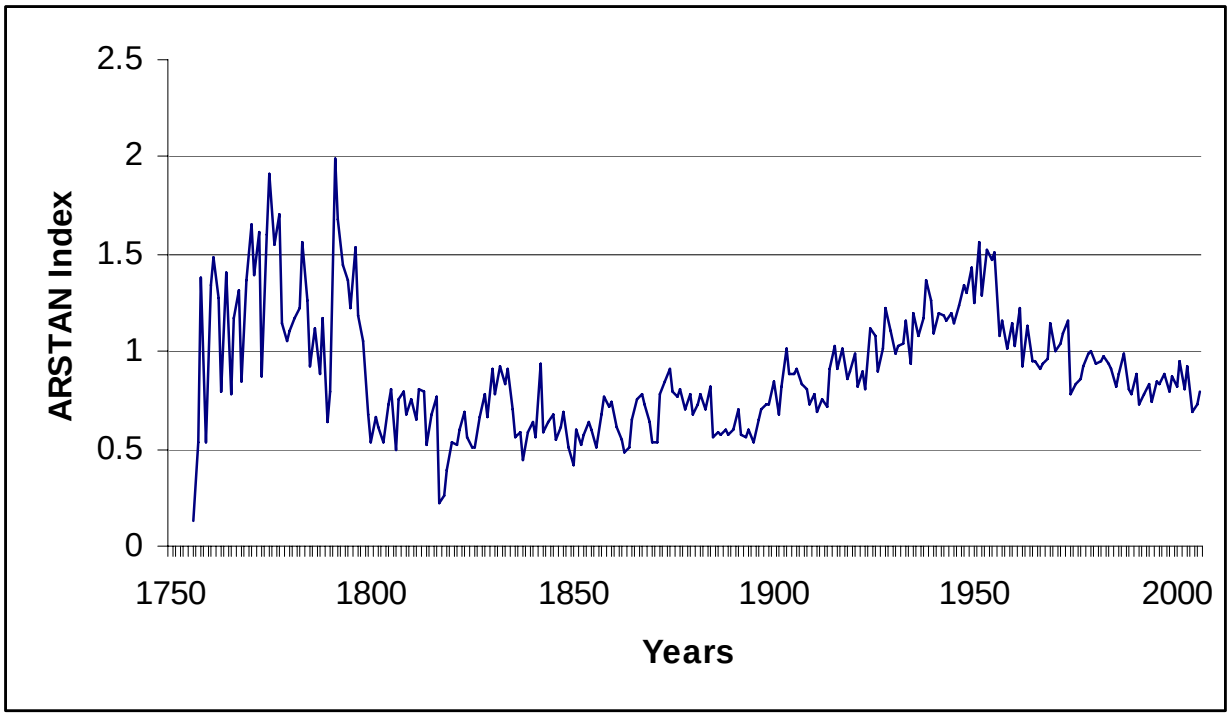

Figure 1.0 – The standardized ARSTAN Index for all cores in the analysis.

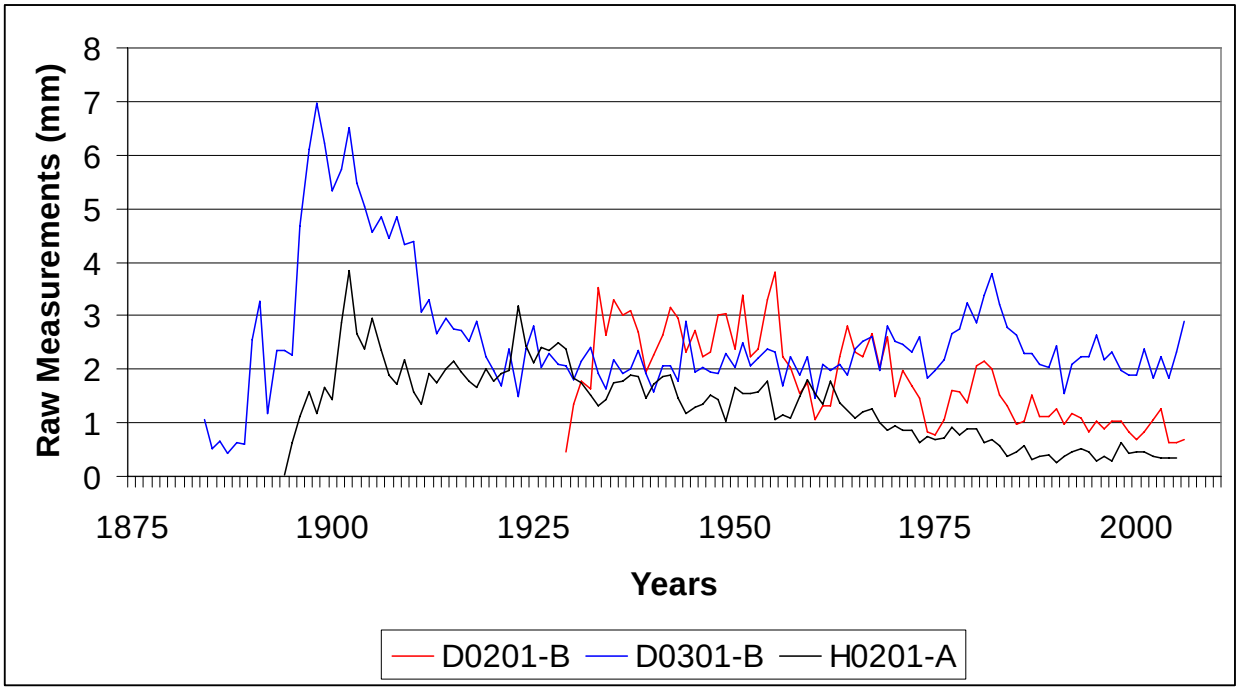

Figure 2.0 – Raw measurements for cores D0201-B, D0301-B, and H0201-A. Note some of the similarities in the raw growth increments of the cores around 1900, 1955, and 1980.

Conclusion

The analysis produced a series of easily graphed columns of data, as well as a regional master chronology that would confirm that the vast majority of the data are of a single species, and are illustrating the same or similar growth signals. This therefore verifies the measurement procedures and reaffirms that the majority of the trees growing in the region are doing so under the influence of a set of environmental variables that are shared throughout the region, between the trees.