The Historical Dendroarchaeology of the Hoskins House, Tannenbaum Historic Park, Greensboro, North Carolina

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Abstract

The Hoskins House is a two-story, single pen log structure located in Tannenbaum Historic Park, Greensboro, North Carolina. The house is thought to have been built by Joseph Hoskins, who lived in Guilford County from 1778 until his death in 1799. Previous archaeological testing of soil around the house yielded over 1000 artifacts, and the ceramics of these gave a Mean Ceramic Date (MCD) of 1810 as a possible initial year of construction. Our objective was to date the outermost rings on as many logs as were accessible in the Hoskins House to determine the year or range of years when the house was likely built. We compared 37 ring-width measurement series from 28 logs with a composite reference chronology created from three individual oak chronologies from Virginia. We found that the majority (if not all) of the 28 logs were cut over a 3-year period from 1811 to 1813, verifying the initial MCD of 1810. Independent verification of our crossdating of these cores was performed by members of the Oxford Dendrochronology Laboratory working in nearby High Point, North Carolina.

Introduction

The Battle of Guilford Courthouse in Guilford County, North Carolina, took place on March 15, 1781 (Baker 2005), and is considered "… the largest, most hotly-contested action of the Revolutionary War's climactic Southern Campaign" (National Park Service (NPS) 2006). Approximately 1,900 British soldiers marched up New Garden Road toward the small, log-house style courthouse that formed the judicial seat of the county, and faced a much larger army of 4,500 American militia made up of companies from neighboring states. A two and a half hour battle eventually forced the American militia led by General Nathaniel Greene into retreat. Today, the battle site is preserved and maintained by the National Park Service's Guilford Courthouse National Military Park (NPS 2006). Adjacent to this park, Tannenbaum Historic Park preserves the place where the Battle of Guilford Courthouse began (Greensboro Parks and Recreation (GPR) 2006).

This 7.5-acre park is dedicated to sharing the story of the Hoskins family and colonial life before, during, and after this pivotal battle in the American Revolution. Joseph Hoskins, his wife Hannah, and their family left Chester County, Pennsylvania, in the spring of 1778, mainly to escape the difficulties brought on by the Revolutionary War as their home was located in close proximity to Valley Forge (GPR 2006). The main structures in the historic park currently consist of a two-story, single-pen, 18 X 24 ft log house (Figure 1), a renovated kitchen (called the "cookhouse" in the original Register of Historic Places registration form, NPS 1988) placed adjacent to this house, and an impressive double-pen cantilever barn known as the "Coble Barn" (NPS 1988). The kitchen structure had been brought in from a location outside the park, while the barn had been relocated from southern Guilford County (NPS 1988; Stine et al. 2003). Only the two-story log house is likely original to the property. The year of construction of this log house is the focus of this study.

In 1999, three 5 x 5 ft test units were excavated around the log house which yielded 1,435 artifacts ranging from the Revolutionary War era through the 20th century (Stine et al. 2003; Stine 2005). Many of these artifacts were wire nails (n = 185, dating ca. post-1830) and machine cut nails (n = 94, dating ca. 1790 to ca. 1830). Curiously, no 18th century hand-wrought nails (ca. pre-1790) were located in any surveys, suggesting that a date of construction for the log house contemporary with the Revolutionary War was not likely. Most important, however, were the ceramics. The ranges of years for the manufacture of specific ceramic types can be averaged to provide a Mean Ceramic Date (MCD, after South 1977). The ceramics in the 1999 collection of artifacts provided a MCD of 1810 (Stine 2005).

Historical Dendroarchaeology

Dendroarchaeological research on historic structures in the southeastern U.S. has increased dramatically in recent years. Bowers and Grashot (1976) first analyzed the possible construction years for structures at President Andrew Jackson's First Hermitage plantation just outside Nashville, Tennessee, but were not able to develop cutting dates for logs used in these structures. Later, Stahle (1979) formalized methods and techniques used in dendroarchaeology in the southeastern U.S. by evaluating the construction histories of numerous log buildings throughout Arkansas. Mann (2002) was the first to combine techniques commonly employed in historical archaeology (assessing the range of years associated with recovered ceramics, nails, and window glass) with tree-ring dating techniques to accurately date the year of construction of a supposed historic blockhouse in eastern Tennessee. Such studies are proving invaluable because many agencies charged with managing historical sites wish to authenticate the reported dates of construction on these log structures. Occasionally, these accepted dates of construction are questionable (e.g., Mann 2002; Grissino-Mayer and van de Gevel 2006) and many structures throughout the Southeast require verification. This verification can be accomplished using dendrochronological techniques that use reference tree-ring chronologies that currently exist for much of the U.S. The process is simple: determining the degree of clustering associated with crossdated cutting dates on logs used in these structures can provide a reasonable range of years when the structure was completed and later occupied (Stahle 1979).

Objective

Our primary objective was to determine the exact year or years when logs were cut and eventually used to build the two-story log house known as the Joseph Hoskins House at Tannenbaum Historic Park. We will use established dendrochronological techniques to date the tree rings in the sampled logs to their exact year of formation. We will then evaluate the outermost partial or complete rings on all sampled logs to assess when the trees were cut that were eventually used to construct this house.

Methods

Field Methods

We extracted at least one core from all accessible logs in the cabin using a custom-made tubular drill bit attached to a variable-speed power hand drill (Figure 2). Cores were taken from both the first and second floors. Cores were labeled by building code (HOS), compass direction of the side of the house (1 letter), log number (beginning with the bottom log = "01" and numbering sequentially upward), and core letter. By convention, "A" is a core taken from the left side of the log and "B" is a core taken from the right side of log, as one faces the log. Cores extracted in intermediate locations are assigned letters "C" and higher. For example, "HOSS09A" represents a core taken from Hoskins House, South side, log 09, core A (left side).

Cores were taken primarily from the lower curved surfaces of the logs, although some cores extracted from logs sampled in the second floor were taken from the upper curved surface.

These lower and upper curved surfaces are sampled because often complete sapwood is present and the outermost rings were likely preserved because of the mud chinking that was always placed between logs to insulate the structure. On logs with clearly defined outer surfaces, we drilled into the log approximately 0.25 inch, then removed the bit and marked the outer surface of core with black ink to verify that the outermost rings remained intact after coring. We then reinserted the drill bit and drilled until we reached the center portion of the log based on a visual assessment. The core was then separated from the log using a special cutting tool inserted alongside the core, extracted, and immediately fastened with wood glue to specially-designed wooden core mounts. The mounted cores were appropriately labeled and allowed to dry several days before sanding with progressively finer grit sandpaper (Orvis and Grissino-Mayer 2002) back in the laboratory.

Internal Crossdating

Absolute dating was accomplished by first dating each series of tree rings against all others ("internal crossdating") using both graphical and statistical crossdating techniques to create an undated (or "floating") tree-ring chronology (Swetnam et al. 1985; Stokes and Smiley 1996; Grissino-Mayer 2001). Once the tree-ring series had been temporally placed relative to each other, this floating chronology was crossdated against a set of regional oak tree-ring chronologies ("external crossdating"). The internal crossdating process began by assigning the innermost complete ring on each core the relative year "1" and marking every subsequent tenth ring with mechanical pencil. We then created skeleton plots of all cores to relatively crossdate the tree rings of each series against all others. Skeleton plots rely on matching patterns of the narrower tree rings in one series against plots of the other series to ensure correct temporal placement. We then measured the widths of all tree rings to 0.001 mm accuracy with a Velmex measuring stage coupled with MEASURE J2X software.

Statistical Verification of External Crossdating

Absolute (“external”) crossdating was accomplished by using COFECHA to compare the undated master chronology with a composite chronology created from three regional oak chronologies from Virginia, archived in the International Tree-Ring Data Bank (ITRDB). All three chronologies were collected and created by Dr. Edward R. Cook of the Lamont-Doherty Earth Observatory at Columbia University:

1. VA009, Blue Ridge Parkway, chestnut oak (*Quercus montana* Michx.), located at 37º33’N, 79º27’W, spanning 1587 to 1982;
2. VA016, Watch Dog, Massenhutten Mountain, chestnut oak, located at 38º30’N, 78º21’W, spanning 1642 to 1981; and,
3. VA017, Patty’s Oaks, Blue Ridge Parkway, white oak, (*Quercus alba* L.), located at 37º55’N, 79º48’W, spanning 1569 to 1982.

We confirmed the graphical crossdating and relative placements of all tree-ring series using COFECHA, a quality-control program that uses segmented time-series correlation techniques to confirm the temporal placements of all tree rings (Holmes 1983). Because crossdating is essentially a “high-frequency” process (pattern matching of sequences of individual rings), COFECHA removes all low-frequency trends using both spline-fitting algorithms and autoregressive modeling (Grissino-Mayer 2001). Such trends could also arise due to natural and human disturbances that otherwise could mask the climate signal desirable for accurate crossdating. COFECHA then tests consecutive 40-yr segments (with 20-yr overlaps) on each series with a temporary master chronology created from all other series. Crossdating is verified when the correlation coefficient for each tested segment exceeds 0.37 ($p < 0.01$), although coefficients are usually much higher (for example, $r > 0.55$, $p < 0.0001$). The final placement made by COFECHA had to be convincing graphically (similar patterns in wide and narrow rings) and statistically. Once confirmed, we assigned absolute years to all individual rings in each measurement series.

Cutting Dates for Logs

Cutting dates for logs were obtained by noting the outermost ring on all cores extracted from logs that had intact outer surfaces. By convention, symbols are assigned to help evaluate the possible year of cutting (Bannister 1962; Nash 1999):

B: bark is present, indicating the outer ring is fully intact (certainly a cutting date);

r: outermost ring is continuous and intact around a smooth surface, but no bark is present (considered a cutting date);

v: the date is within a few years of the cutting date, based on presence of sapwood (near cutting date);

vv: impossible to determine how far the outer ring is from the true outer surface (no sapwood and rings in the heartwood could also be missing).

Results

Descriptive Statistics

The average mean sensitivity was 0.21 (lowest = 0.12 for core HOSS07A; highest = 0.33 for core HOSE10B; Table 1), higher than the average reported for 16 other white oak chronologies from the eastern and central U.S. (average of 0.16, with upper 95% confidence limit of 0.20; Dewitt and Ames 1978). The average interseries correlation for the 37 cores was 0.65 (lowest r = 0.29 for core HOSW06B, n = 105 years; highest r = 0.86 for core HOSN09B, n= 41 years, Table 1). This value is exceptional by dendrochronological standards, and especially considering that hardwood species generally have lower interseries correlations than do conifer species.

Internal Crossdating

Most logs sampled were cut from species in the white oak group, most likely white oak (*Quercus alba* L.). Of 53 cores extracted from the cabin, 37 samples from 28 logs could be conclusively crossdated (their measurements are included in Appendix 1). Of 105 40-yr segments tested by COFECHA in these 37 measurement series, only eight segments were flagged by the COFECHA software because of possible errors (Table 1; Appendix 2), but inspection of these segments indicated correct temporal placements. Such flagged segments occasionally arise due to erratic ring sequences caused by local disturbances affecting the ring patterns (such as wildfires) rather than representing misdated ring segments. Sixteen cores could not be crossdated, either internally against other cores or externally against the reference chronologies, and were excluded from further analysis. These cores included those that (1) contained an insufficient number of rings (less than 30), (2) contained injuries that caused erratic ring sequences, or (3) represented tree species with rings that were barely discernible (e.g., tulip poplar, *Liriodendron tulipifera* L.).

External Crossdating

Comparison of the standard index chronology created from the Hoskins House measurement series graphically with the composite reference chronology created from the three oak chronologies in Virginia revealed a strong agreement (Figure 3). This graphical agreement was verified statistically using the COFECHA by first comparing the undated chronology created from the Hoskins House with the composite reference chronology. We found that that all 40-yr segments (lagged 10 yrs) tested significantly (average $r = 0.51$, $n = 40$, $t = 3.65$, $p < 0.001$) against the composite chronology with a dating adjustment of +1723, suggesting that our chronology for the Hoskins House was now anchored from 1723 to 1831. The correlation between the two data sets was statistically significant over the period 1723 to 1813 ($r = 0.45$, $n = 89$, $t = 4.7$, $p < 0.0001$). This shorter period was used for statistical testing because only one sample (HOSW06B, likely a replacement log) extended the chronology from 1813 to 1831.

Discussion

The trees that were harvested and eventually used to construct the Hoskins House were clearly cut within a three-year period in the years 1811, 1812, and 1813. Four oak trees had outermost dates of 1811, which indicated the initial cutting of trees, but the majority of trees used in the log structure were cut in the year 1812 (13 trees). Eight trees in our final sample of 28 logs were then harvested in the year 1813. Closer inspection of the 1813 tree rings on these eight logs suggest that the 1813 ring may be a partial ring. The earlywood is clearly formed on all eight logs, but the latewood on all eight appears narrower than on preceding rings, suggesting the latewood is partial. This strongly suggests that these eight oak trees were likely harvested in the late spring or early summer of the year 1813. No earlywood vessels for the year 1814 were found on any core. We propose that the Hoskins House was completed in the summer or fall of 1813.

Only three logs had outermost dates other than the 1811–1813 range of years. One log (HOSN06) had an outermost ring of 1810, which occurred because the outer rings had obviously disintegrated during sampling (no ink mark was visible on the outer ring on the core). Another log (HOSE10) had an outermost ring in the year 1806 but the additional outer rings were indistinct on this core due to decay. Finally, one log (HOSW06B) curiously had an outermost ring of 1831. We believe this core may have been extracted from a partial log (number 6 on the west wall) that had been inserted as a replacement log, as partial replacement logs were common in the structure. To support this, the log was also the oldest of any log sampled in the Hoskins House, suggesting that it was not part of the original log structure. The rings in this log also had a lower than average interseries correlation with the other logs (0.29) which further suggests this tree came from a different stand of trees than those used in the log structure. However, because the series of rings in this log still has a statistically significant correlation, despite it being lower, we believe this tree came from the immediate vicinity of the region.

To ensure the veracity of the dates of tree rings obtained for the 37 cores sampled from the Hoskins House, we passed our tree-ring measurements to an independent tree-ring expert who is currently analyzing the construction years for many historic structures throughout the eastern United States. Mr. Daniel Miles is a co-founder (along with Michael J. Worthington) of the Oxford Dendrochronology Laboratory in Oxford, England, an independent tree-ring dating facility that maintains close ties with the Research Laboratory for Archaeology and the History of Art at Oxford University. Mr. Miles has recently been examining the years of construction for another famous historic structure located in nearby High Point, North Carolina. He was able to verify, using his recently developed tree-ring data, that the outermost rings on the logs from the Hoskins House did indeed date to the period 1811 to 1813 (Daniel Miles, personal communication, 25 March 2006).

The early 1800s construction date is also supported by the number of rings found in each log. We have found that log structures built from the oldest trees in a region that had not witnessed considerable settlement-era logging often display a considerable number of rings in the logs. For example, 30 oak logs at the Rocky Mount historic site in northeastern Tennessee had an average of 99 rings per log (Grissino-Mayer and van de Gevel 2006). Ring counts on logs from Abraham Lincoln's Boyhood Cabin, located just north of Hodgenville, Kentucky, showed an amazing 150 rings per log, strongly suggesting the cabin was constructed from old-growth oak and tulip poplar logs. Alternatively, the number of rings on logs used to reconstruct Abraham Lincoln's birthplace log cabin averaged only 40 rings, indicating this structure could not date to the year 1809, the year of Lincoln's birth (the trees were in fact, cut in the 1840s and 1850s, proving the cabin is a hoax). The average number of rings found in the 28 logs in the Hoskins House was 61, strongly suggesting that these trees had not been growing in an old-growth stand of trees when harvested. Instead, these oak trees could have been come from a second-growth forest in the vicinity, or these trees could represent residual trees left over from the initial cutting that took place on the property during the early phases of settlement. The property was believed settled as early as 1762 by Robert Mitchell, who at one time was thought to be the builder of the Hoskins House (NPS 1988).

After the death of Joseph Hoskins in 1799, the property was passed to his two sons, Joseph and Ellis (Stine et al. 2003). The will stipulated that the portion of the property with the house go to his son Joseph, but the property must have eventually passed into the hands of his son Ellis who eventually deeded the property to his son J.E. Hoskins (Stine et al. 2003). Therefore, the log house located at Tannenbaum Historic Park may be more correctly called the "Ellis Hoskins House" rather than the "Joseph Hoskins House" (Adrienne Byrd, personal communication, 3 April 2006).

The correspondence of the 1811–1813 cutting dates for the logs used in the Hoskins House with the Mean Ceramic Date of 1810 (Stine et al. 2003) is nothing short of remarkable and a testament to the efficacy of dating techniques based on the assessment of historical artifacts recovered from soil tests at historic sites. Mann (2002) summarized the techniques used to develop a MCD, after South (1977). The MCD is obtained by taking the sum of the artifacts making up the median date for the manufacturing date range for each ceramic shard and then multiplying by the total frequency, or the count in any given interval, and dividing the sum by the number of shards in the total population. Using these techniques, Mann (2002) obtained a MCD of 1852 for the Swaggerty Blockhouse in eastern Tennessee. Tree-ring dating of 10 logs from this historic structure revealed all trees had been cut in the spring of 1860, and not in 1787 as was once believed. Mann (2002) and Stine et al. (2003) clearly demonstrate the importance of using complementary techniques from both historical archaeology and dendrochronology to establish (1) construction dates of historic structures, (2) the duration of occupation of historical sites, and (3) how such historic sites were used by its occupants.

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Table 1. Descriptive statistics for all 37 crossdated cores extracted from 28 logs from the Hoskins House.

Core Number	Core Identification	Begin Year	End Year	Total Rings	Segments Tested	Segments Flagged	Series Intercorrelation	Mean Sensitivity
1	HOSN03A	1755	1800	46	3	0	0.835	0.253
2	HOSN03B	1754	1813	60	3	0	0.751	0.250
3	HOSN04A	1763	1803	41	2	0	0.741	0.172
4	HOSN06B	1761	1810	50	2	0	0.609	0.275
5	HOSN07A	1735	1785	51	3	0	0.585	0.210
6	HOSN08A	1750	1796	47	2	0	0.656	0.222
7	HOSN08B	1749	1813	65	3	0	0.750	0.228
8	HOSN09A	1759	1812	54	3	0	0.748	0.190
9	HOSN09B	1767	1807	41	2	0	0.863	0.208
10	HOSN11A	1743	1812	70	3	0	0.745	0.197
11	HOSN12B	1736	1813	78	4	0	0.692	0.225
12	HOSE04B	1723	1811	89	4	0	0.568	0.194
13	HOSE05A	1732	1812	81	4	0	0.667	0.202
14	HOSE07A	1772	1807	36	1	0	0.704	0.232
15	HOSE08A	1739	1805	67	4	0	0.644	0.203
16	HOSE08B	1751	1812	62	3	0	0.708	0.205
17	HOSE09A	1755	1812	58	3	0	0.759	0.195
18	HOSE10B	1761	1797	37	1	0	0.655	0.325
19	HOSS03A	1761	1813	53	2	0	0.787	0.196
20	HOSS05A	1733	1813	81	4	1	0.491	0.202
21	HOSS05B	1733	1795	63	3	1	0.540	0.199
22	HOSS06A	1742	1812	71	3	0	0.752	0.224
23	HOSS06B	1752	1802	51	3	0	0.826	0.243
24	HOSS07A	1745	1812	68	3	1	0.433	0.124
25	HOSS07B	1752	1812	61	3	1	0.405	0.177
26	HOSS08A	1760	1812	53	2	0	0.752	0.199
27	HOSS09A	1749	1806	58	3	0	0.724	0.197
28	HOSS09B	1744	1811	68	3	0	0.758	0.212
29	HOSW06A	1760	1812	53	2	0	0.805	0.222
30	HOSW06B*	1727	1831	105	4	2	0.293	0.207
31	HOSW06C	1760	1812	53	2	0	0.777	0.184
32	HOSW07C	1747	1813	67	3	0	0.723	0.163
33	HOSW09A	1750	1813	64	3	0	0.548	0.176
34	HOSW10A	1763	1812	50	2	0	0.793	0.174
35	HOSW11A	1745	1811	67	3	2	0.310	0.203
36	HOSW12A	1728	1812	85	4	0	0.613	0.239
37	HOSW14A	1742	1800	59	3	0	0.470	0.207
				Total or Mean	**105**	**8**	**0.647**	**0.207**

* HOSW06B is not similar in length or appearance to cores HOSW06A and HOSW06C, suggesting to us this could be a core extracted from a (partial) replacement log.

Table 2. Cutting or outermost dates for the 28 logs sampled from the Hoskins House.

Log Number	Log Identification	Inner Ring	Last Measured Ring	Outer Ring	Outer Ring Type	Comments
1	HOSN03	1754	1813	1813	r	Cutting date
2	HOSN04	1763	1803	1813	r	Outer rings crossdated, not measured. Cutting date.
3	HOSN06	1761	1810	1810	v	Near cutting date
4	HOSN07	1735	1785	1812	r	Outer rings crossdated, not measured. Cutting date.
5	HOSN08	1749	1813	1813	r	Cutting date
6	HOSN09	1759	1812	1812	r	Cutting date
7	HOSN11	1743	1812	1812	r	Cutting date
8	HOSN12	1736	1813	1813	r	Cutting date
9	HOSE04	1723	1811	1811	r	Cutting date
10	HOSE05	1732	1812	1812	r	Cutting date
11	HOSE07	1772	1807	1812	r	Outer rings crossdated, not measured. Cutting date.
12	HOSE08	1739	1812	1812	r	Cutting date
13	HOSE09	1755	1812	1812	r	Cutting date
14	HOSE10	1761	1797	1806	vv	Outer rings unclear, not measured.
15	HOSS03	1761	1813	1813	r	Cutting date
16	HOSS05	1733	1813	1813	r	Cutting date
17	HOSS06	1742	1812	1812	r	Cutting date
18	HOSS07	1745	1812	1812	r	Cutting date
19	HOSS08	1760	1812	1812	r	Cutting date
20	HOSS09	1744	1811	1811	r	Cutting date
21	HOSW06A	1760	1812	1812	r	Cutting date
22	HOSW06B*	1727	1831	1831	r	Cutting date, likely a portion of replacement log.
23	HOSW07	1747	1813	1813	r	Cutting date
24	HOSW09	1750	1813	1813	r	Cutting date
25	HOSW10	1763	1812	1812	r	Cutting date
26	HOSW11	1745	1811	1811	r	Cutting date
27	HOSW12	1728	1812	1812	r	Cutting date
28	HOSW14	1742	1800	1811	r	Outer rings crossdated, not measured. Cutting date.

* HOSW06B is not similar in length or appearance to cores HOSW06A and HOSW06C, suggesting to us this could be a core extracted from a (partial) replacement log.

Figure 1. The Joseph Hoskins House, located at Tannenbaum Historic Park, Greensboro, North Carolina. The log structure is currently covered with clapboard siding. The house is believed to date to the Revolutionary War period (ca. 1781), but archaeological testing suggests a later date of construction (Stine 2005).

Figure 2. Joe Henderson shown extracting a core from the rounded portion of a log in the Hoskins House with a hollow tubular drill bit.

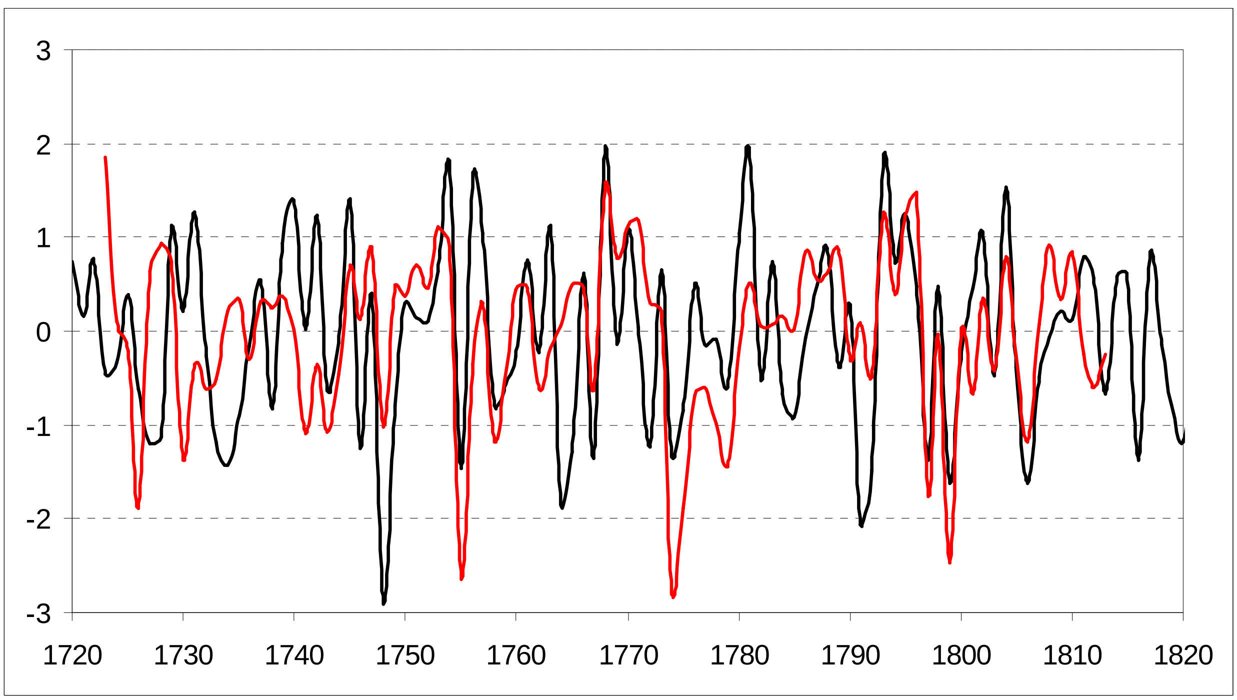

Figure 3. Comparison of the Hoskins House master chronology (red) with the composite created from the three oak chronologies located in Virginia (black). Values on the y-axis are dimensionless indices.

Appendix 1. Ring-width measurements for the 37 series from 28 logs sampled at the Hoskins House, Greensboro, North Carolina. The data are archived in internationally accepted Tucson (or Decadal) format for tree-ring data. Measurements below are in 0.001 mm format, e.g. a value of 1705 is actually 1.705 mm in width. The value “-9999” is an end-of-series sentinel.

HOSN03A	1755	653	1850	1705	934	1655					
HOSN03A	1760	2225	2068	1754	1312	1388	1516	2024	1517	2246	2042
HOSN03A	1770	2973	3182	2485	2367	870	1252	1715	1793	1601	1440
HOSN03A	1780	1926	2819	2123	2226	2148	2170	2476	2186	2608	2238
HOSN03A	1790	1827	2247	1681	2033	1479	2171	1642	1089	1330	935
HOSN03A	1800	1102	-9999								
HOSN03B	1754	2539	706	1659	1943	1283	1938				
HOSN03B	1760	2447	2237	1959	1399	1740	1514	1778	1295	2339	1925
HOSN03B	1770	2725	3464	2608	2843	939	1511	2001	1997	1737	1435
HOSN03B	1780	1792	2651	1990	2214	2243	2320	2763	2419	2617	2210
HOSN03B	1790	1774	1940	1524	1725	1191	1891	1185	844	1379	991
HOSN03B	1800	1482	1448	1744	1466	1642	1465	1543	1700	1725	1224
HOSN03B	1810	1239	1318	1306	1129	-9999					
H0SN04A	1763	4009	3966	3786	3885	2511	2950	2321			
H0SN04A	1770	2531	2851	2059	1855	1147	946	983	978	1082	1332
H0SN04A	1780	1804	2103	1368	1866	1470	1449	2280	2391	2615	2694
H0SN04A	1790	2741	2415	2716	3014	2498	2894	2909	1869	2245	1596
H0SN04A	1800	1983	1570	1722	1821	-9999					
HOSN06B	1761	887	671	965	611	1445	1833	1662	3668	1602	
HOSN06B	1770	1781	1125	1134	1148	803	925	929	1658	1398	995
HOSN06B	1780	1177	1972	1474	1287	1519	1667	1928	1635	1646	1636
HOSN06B	1790	1527	1755	2700	4662	3626	4593	3743	1747	2823	1775
HOSN06B	1800	2688	2007	2448	2104	2657	2254	2527	3277	2727	2260
HOSN06B	1810	2673	-9999								
HOSN07A	1735	1398	1053	1074	705	1150					
HOSN07A	1740	1002	1028	979	779	743	671	952	1292	1391	1472
HOSN07A	1750	1631	2183	2384	1951	2464	1007	1253	1188	863	1467
HOSN07A	1760	1400	1151	900	1373	1338	1197	1303	975	1688	1153
HOSN07A	1770	1659	1488	1142	979	834	1115	1131	1141	1096	905
HOSN07A	1780	1281	1239	998	1291	1317	955	-9999			
HOSN08A	1750	1892	2746	2342	3274	1500	960	1152	1262	1033	1324
HOSN08A	1760	1629	2093	2074	2416	2304	1952	1976	1569	2679	2305
HOSN08A	1770	2785	2291	1802	2025	963	1690	1914	1705	1531	1116
HOSN08A	1780	1948	1872	1703	1837	1896	2197	3339	2355	2130	1661
HOSN08A	1790	1571	1310	1272	1460	2110	2316	2642	-9999		
HOSN08B	1749	2363									
HOSN08B	1750	2783	2694	1927	2611	1450	1039	1428	1267	998	1392
HOSN08B	1760	1590	1909	1742	2028	2009	1678	1650	1330	2408	2558
HOSN08B	1770	2107	2801	1809	1910	762	1467	1573	1540	1280	889
HOSN08B	1780	1902	2134	1871	1940	1992	2422	3379	2905	2477	2136
HOSN08B	1790	1654	1323	1159	1364	1485	1925	2564	1314	1604	783
HOSN08B	1800	1707	1382	1568	1307	1410	1235	1189	1200	1268	1539
HOSN08B	1810	1302	1129	1002	1012	-9999					
HOSN09A	1759	1410									
HOSN09A	1760	3125	2635	1655	3758	4314	4091	3112	2582	4487	2929
HOSN09A	1770	3048	3005	2913	2696	1381	1434	1449	1528	1094	1067
HOSN09A	1780	1322	2124	2116	2328	2654	2308	2801	2526	2585	2497
HOSN09A	1790	2149	2254	2458	3040	3054	3512	3235	1678	2230	1721
HOSN09A	1800	2376	2253	2537	2119	1883	1918	1896	2405	2074	2012
HOSN09A	1810	2587	2356	1981	-9999						
HOSN09B	1767	2055	4060	2808							

HOSN09B	1770	3306	3154	2288	2596	1232	1116	1045	1287	1257	1096
HOSN09B	1780	1655	2250	1759	1638	2125	2112	2527	1988	2236	2401
HOSN09B	1790	1983	2184	2194	3108	2640	3324	3061	1473	2029	1571
HOSN09B	1800	2035	2143	2408	2449	2766	2047	1878	2186	-9999	
HOSN11A	1743	1101	1604	2028	1411	1356	1185	2086			
HOSN11A	1750	1315	1872	2568	2683	2345	1155	2281	2389	1636	1710
HOSN11A	1760	1526	1831	1340	1407	1586	1552	1699	1494	2005	1759
HOSN11A	1770	1969	2118	1489	1558	933	998	1420	1189	1203	899
HOSN11A	1780	1107	987	1167	1409	1287	1180	1223	1625	1651	1776
HOSN11A	1790	1372	1222	1308	1590	1534	1717	2003	1313	1725	1103
HOSN11A	1800	1728	1171	1250	1095	1327	1067	914	1112	1135	1212
HOSN11A	1810	1248	1075	1057	-9999						
HOSN12B	1736	476	1685	1959	371						
HOSN12B	1740	377	672	1436	995	1372	2070	1661	1717	1222	1634
HOSN12B	1750	1808	1699	1135	1516	2102	913	1542	1592	1407	1457
HOSN12B	1760	1810	1629	1479	1797	1535	1986	1817	1404	1955	1342
HOSN12B	1770	1539	1951	1381	1096	765	675	700	629	741	689
HOSN12B	1780	831	782	899	832	831	1140	1294	1162	1198	1295
HOSN12B	1790	1023	1004	879	1154	951	1334	1326	953	1050	703
HOSN12B	1800	931	830	775	808	1200	1016	941	954	1046	975
HOSN12B	1810	955	798	643	664	-9999					
HOSE04B	1723	1797	1582	1545	1315	1756	1589	1708			
HOSE04B	1730	978	1587	1550	1554	2534	1575	1616	2112	2016	3060
HOSE04B	1740	1530	998	1603	1215	1102	1280	1432	1336	1311	1618
HOSE04B	1750	1442	1492	1589	1382	1287	700	1216	1250	1237	1284
HOSE04B	1760	1756	1281	1074	992	1122	1123	1218	988	1717	1235
HOSE04B	1770	1201	1285	1150	1048	651	787	1317	1153	978	990
HOSE04B	1780	1148	1021	853	1289	1236	1161	1361	1465	1447	1322
HOSE04B	1790	1577	1404	1084	1577	1009	1331	1358	1138	1188	979
HOSE04B	1800	771	894	975	775	950	991	832	651	877	787
HOSE04B	1810	732	543	-9999							
HOSE05A	1732	1261	746	2120	2313	2172	1537	1131	1881		
HOSE05A	1740	1617	886	1015	754	1045	1369	1144	1298	819	1341
HOSE05A	1750	1427	1400	1533	1175	1669	986	1198	1504	1462	1602
HOSE05A	1760	1666	2127	1851	2122	1976	2113	1638	1427	2095	1994
HOSE05A	1770	2091	1482	1233	908	845	795	1095	1077	893	781
HOSE05A	1780	1271	957	1112	1268	1382	1615	1994	1853	1985	1947
HOSE05A	1790	1778	1628	1688	1961	1740	2124	3449	1927	1936	1357
HOSE05A	1800	1866	1822	1795	1565	1743	1458	1274	1198	1669	1535
HOSE05A	1810	1777	1729	1887	-9999						
HOSE07A	1772	2510	2163	938	880	892	743	556	730		
HOSE07A	1780	1254	1603	1440	1448	1353	1309	1935	1959	1603	1617
HOSE07A	1790	1391	1893	1527	2207	2047	2620	2108	920	1353	1090
HOSE07A	1800	2151	1925	2319	2117	1981	1465	2006	2210	-9999	
HOSE08A	1739	1156									
HOSE08A	1740	1139	718	829	1340	1966	2487	1685	2763	1570	1319
HOSE08A	1750	1923	2066	1722	2035	2001	885	1030	1413	953	1080
HOSE08A	1760	1346	1373	891	920	921	1219	1042	860	1297	1092
HOSE08A	1770	1182	1294	1220	1150	694	683	983	929	749	1206
HOSE08A	1780	1349	1426	1310	1470	1463	1075	1121	1031	1170	898
HOSE08A	1790	835	1061	987	1312	844	1057	875	902	967	822
HOSE08A	1800	993	926	1116	941	1048	1106	-9999			
HOSE08B	1751	1686	1702	1923	2021	708	1336	1626	1081	1056	
HOSE08B	1760	1674	1446	1062	881	1588	1517	1333	1320	2082	2010
HOSE08B	1770	1694	1821	2002	1958	1096	1001	1496	1386	1080	1252
HOSE08B	1780	1705	2449	2423	1774	1957	1702	1664	1384	1167	1373
HOSE08B	1790	1189	1107	833	980	874	1356	1117	1021	1088	795

HOSE08B	1800	1056	905	1333	1182	1560	1456	1064	1060	1477	1347
HOSE08B	1810	1290	1217	1059	-9999						
HOSE09A	1755	943	1242	1516	998	2073					
HOSE09A	1760	2315	1538	1462	1496	1852	2051	1784	1444	1963	1929
HOSE09A	1770	2447	2749	1891	1697	799	879	1024	1128	1189	1672
HOSE09A	1780	2374	3132	2583	2255	1924	1697	2341	1819	2217	2475
HOSE09A	1790	1889	2135	1693	2230	2112	2256	2018	1198	1598	1209
HOSE09A	1800	1477	1374	1329	1113	1119	1011	1029	1370	1440	1236
HOSE09A	1810	1393	1298	1212	-9999						
HOSE10B	1761	3050	2933	689	850	1603	2318	2225	3103	2241	
HOSE10B	1770	2061	881	1685	1313	474	2324	2473	1911	2575	1377
HOSE10B	1780	2409	3302	2210	2123	1955	2070	2498	3181	3117	3172
HOSE10B	1790	2607	2368	1941	2610	2364	2344	2185	1425	-9999	
HOSS03A	1761	1534	1870	3057	2192	1799	2701	2330	3466	3357	
HOSS03A	1770	3380	2630	2079	2407	1108	853	1047	1287	1390	1205
HOSS03A	1780	1918	1756	1899	2058	2280	1999	2571	2357	1846	2077
HOSS03A	1790	1783	1977	1651	2103	2252	2315	2252	1271	1596	1116
HOSS03A	1800	2057	1689	2031	1744	1772	1379	1311	1466	1553	1347
HOSS03A	1810	1505	1396	1278	1458	-9999					
HOSS05A	1733	877	1036	1573	910	1033	1587	524			
HOSS05A	1740	750	1130	1100	1026	1915	2468	1947	2007	1680	2988
HOSS05A	1750	2872	2475	2202	2535	2483	1754	2539	2426	1895	1656
HOSS05A	1760	1657	1888	1206	1513	1581	1835	1794	1271	1503	1494
HOSS05A	1770	1402	1186	1209	1100	764	700	887	789	677	630
HOSS05A	1780	621	648	791	651	770	578	657	645	742	813
HOSS05A	1790	774	908	857	1211	939	867	1510	730	870	577
HOSS05A	1800	843	611	679	552	778	703	651	645	853	705
HOSS05A	1810	757	752	806	714	-9999					
HOSS05B	1733	1754	757	665	933	1722	1648	1113			
HOSS05B	1740	1958	1418	1098	931	1485	2311	2023	2403	1575	2059
HOSS05B	1750	1869	1739	1599	1927	2123	1722	2256	2402	1860	1725
HOSS05B	1760	1527	1851	1481	1934	2211	2582	2601	1648	1648	1505
HOSS05B	1770	1739	1441	1129	1036	647	609	768	699	782	710
HOSS05B	1780	839	855	799	758	764	639	702	610	784	859
HOSS05B	1790	823	1055	938	1317	1094	947	-9999			
HOSS06A	1742	1456	1150	1190	1613	1497	2041	1306	1730		
HOSS06A	1750	1291	1698	1346	1835	1752	792	1017	1642	1199	1177
HOSS06A	1760	1475	1868	1552	1606	1645	1962	1715	1263	2006	1588
HOSS06A	1770	2135	2478	1679	1575	808	1040	1158	1456	1240	1426
HOSS06A	1780	1509	3540	3066	2905	2169	1931	1732	1398	1974	2075
HOSS06A	1790	1817	1719	1874	2563	2441	2785	2507	1660	2558	1734
HOSS06A	1800	2866	1991	2501	2301	2583	1640	1759	2430	2258	2279
HOSS06A	1810	2106	2071	1868	-9999						
HOSS06B	1752	1420	1999	1994	1036	1330	1700	1197	1350		
HOSS06B	1760	1900	2026	1614	2118	1910	1990	1879	1355	2019	1441
HOSS06B	1770	1971	2285	1569	1556	701	848	1048	1252	1031	1079
HOSS06B	1780	1718	897	813	1041	1398	1162	1442	1756	1935	2381
HOSS06B	1790	1930	2356	2251	2762	2798	3034	2422	1595	2248	1443
HOSS06B	1800	2385	1933	2290	-9999						
HOSS07A	1745	1092	1169	1192	1007	1000					
HOSS07A	1750	1158	1144	1204	1429	1562	1303	1161	1179	1161	932
HOSS07A	1760	893	1129	995	733	707	835	765	803	1185	1134
HOSS07A	1770	1470	1446	1337	1175	972	1028	1195	1214	1064	1258
HOSS07A	1780	1311	1217	1149	1111	1449	1839	1886	2447	2309	3298
HOSS07A	1790	2766	3028	2873	3761	3615	4216	4265	2815	3077	2401
HOSS07A	1800	2978	2715	2596	2629	2915	2765	1832	2054	2304	2103
HOSS07A	1810	2159	1902	1924	-9999						

HOSS07B	1752	1038	911	1153	1279	1268	1134	850	1047		
HOSS07B	1760	996	1204	983	683	757	831	885	810	1093	1171
HOSS07B	1770	1301	1468	1392	1384	894	963	1309	1351	1052	1143
HOSS07B	1780	1382	2750	1990	1510	1678	2193	5003	2282	2097	2867
HOSS07B	1790	2514	2929	2903	3424	3284	3653	3575	2382	2572	2093
HOSS07B	1800	2652	2400	2426	2502	2850	2661	1786	2176	2300	2040
HOSS07B	1810	1998	1852	1761	-9999						
HOSS08A	1760	3716	2124	2325	2144	2878	4170	3851	3160	3563	3016
HOSS08A	1770	2856	2429	2860	2223	921	1056	1800	1607	1466	849
HOSS08A	1780	1676	1861	1896	1668	1518	1452	1451	1391	1315	1308
HOSS08A	1790	1181	1247	1347	1556	1678	1564	2184	801	1441	998
HOSS08A	1800	1000	1145	1284	897	1005	972	917	1193	1245	1173
HOSS08A	1810	1382	1050	1128	-9999						
HOSS09A	1749	2556									
HOSS09A	1750	1691	2221	1927	2555	2013	916	991	1722	887	1251
HOSS09A	1760	2141	2144	1755	1787	1652	2094	1999	1709	2435	1937
HOSS09A	1770	1745	2005	1537	1559	773	1321	1631	1709	1627	1854
HOSS09A	1780	1458	2010	2199	1744	2124	2144	2196	2202	2102	2480
HOSS09A	1790	1882	2134	2039	2085	2015	1784	2037	1254	1244	1167
HOSS09A	1800	1367	1578	1558	1607	1634	1090	946	-9999		
HOSS09B	1744	1483	2219	1606	2048	1359	2229				
HOSS09B	1750	1382	2468	2096	2592	2157	863	937	1513	767	1084
HOSS09B	1760	1723	1797	1553	1863	1814	2052	2044	1968	2944	2521
HOSS09B	1770	2313	2533	1977	2263	851	1333	1926	2184	1918	1797
HOSS09B	1780	1579	2090	2180	1989	2208	2361	2525	2696	2495	3054
HOSS09B	1790	2147	2297	1977	2108	1937	1815	1914	1265	1173	1105
HOSS09B	1800	1417	1101	1423	1560	1465	1412	1161	1675	1640	1760
HOSS09B	1810	1919	1938	-9999							
HOSW06A	1760	2712	2501	2384	2186	1950	2816	2440	2072	3162	2955
HOSW06A	1770	2661	3578	2527	2606	1185	754	996	1192	1359	1056
HOSW06A	1780	1420	2292	2212	2364	2345	2656	3186	2629	2977	3377
HOSW06A	1790	2141	2448	2042	3128	3098	3214	2955	1189	1655	980
HOSW06A	1800	1796	1750	2291	1790	2307	1783	1864	2063	1869	2558
HOSW06A	1810	1970	1653	1645	-9999						
HOSW06B	1727	2595	3216	2590							
HOSW06B	1730	2509	1522	421	552	621	475	443	415	537	849
HOSW06B	1740	1066	635	937	906	499	800	785	738	831	1027
HOSW06B	1750	1106	1336	1000	1195	1244	446	973	1000	1241	1136
HOSW06B	1760	1304	1310	1317	1519	1173	1066	1315	1394	1062	1227
HOSW06B	1770	939	1141	1108	1059	772	904	888	1029	1338	830
HOSW06B	1780	737	871	986	1024	597	792	695	1021	675	829
HOSW06B	1790	684	511	562	766	797	771	938	753	634	832
HOSW06B	1800	915	945	947	661	1001	938	730	740	903	823
HOSW06B	1810	769	843	951	1108	1243	1105	1218	890	1261	1843
HOSW06B	1820	1686	1305	1420	1236	1109	1922	1423	1508	1687	1612
HOSW06B	1830	1415	1439	-9999							
HOSW06C	1760	2244	2120	2138	2762	2807	2384	2166	1876	3008	3089
HOSW06C	1770	2560	2852	2106	2018	1010	773	954	1078	1243	1013
HOSW06C	1780	1025	1799	1828	1909	1943	2367	3142	2607	2924	2965
HOSW06C	1790	2001	2284	1987	2867	2849	3014	2646	1224	1489	1066
HOSW06C	1800	1688	1380	1898	1577	1904	1526	1598	1757	1670	1860
HOSW06C	1810	1690	1520	1378	-9999						
HOSW07C	1747	2085	1618	1641							
HOSW07C	1750	1681	1612	1523	1675	1801	863	1293	1637	1308	1304
HOSW07C	1760	1240	1618	1202	1137	1231	1648	1379	1444	1733	1627
HOSW07C	1770	1984	1839	1371	1764	1103	1055	1279	1076	994	1213
HOSW07C	1780	1756	1392	1319	1085	1238	1572	1746	1564	1793	1658

HOSW07C	1790	1472	1551	1780	2391	1843	1986	1865	1306	1703	1298
HOSW07C	1800	1736	1349	1575	1503	1850	1615	1482	1614	1847	1622
HOSW07C	1810	1514	1548	1554	1476	-9999					
HOSW09A	1750	3497	2503	4513	4205	2161	2410	2612	1779	1699	2005
HOSW09A	1760	2496	2722	1856	2194	2091	1615	1931	1374	1930	1709
HOSW09A	1770	1759	2041	1286	1338	869	861	733	671	659	771
HOSW09A	1780	945	1242	1157	1273	1397	1553	1709	1360	1621	1659
HOSW09A	1790	1207	1608	1655	1960	1424	1314	1483	1116	1296	861
HOSW09A	1800	1131	1058	1202	1223	1324	1083	939	1095	1005	986
HOSW09A	1810	1130	995	990	1089	-9999					
HOSW10A	1763	1927	2194	2407	1978	1422	2667	2625			
HOSW10A	1770	2917	2668	1871	1323	915	704	1535	1631	1488	1293
HOSW10A	1780	1768	1835	1881	1658	1665	1387	1556	1766	1729	1792
HOSW10A	1790	1285	1293	1249	2003	1797	1726	1664	1078	1332	906
HOSW10A	1800	1174	1083	1649	1670	1897	1785	1774	2151	1972	1873
HOSW10A	1810	2242	2019	1947	-9999						
HOSW11A	1745	2549	1956	2094	1319	1630					
HOSW11A	1750	2105	1417	1618	1983	661	758	901	878	695	681
HOSW11A	1760	583	626	479	441	595	641	422	363	670	659
HOSW11A	1770	315	265	319	370	420	393	461	696	534	697
HOSW11A	1780	740	842	1104	1265	1490	1260	1001	1318	1194	1463
HOSW11A	1790	1410	1601	1371	1362	1084	1046	1415	1274	1677	826
HOSW11A	1800	1388	1585	1211	1111	1085	1105	1180	977	1024	1040
HOSW11A	1810	951	867	-9999							
HOSW12A	1728	2139	1633								
HOSW12A	1730	331	733	1436	660	970	1005	1035	1292	1718	2869
HOSW12A	1740	1798	1156	1843	1706	1722	1528	1452	1836	1281	1810
HOSW12A	1750	1523	1714	1458	1344	1676	609	983	1112	1122	1620
HOSW12A	1760	1786	2034	1653	1469	1635	1584	1638	1408	2181	1502
HOSW12A	1770	1437	819	747	875	510	737	1291	1200	925	801
HOSW12A	1780	865	575	533	547	599	854	844	1131	1299	1458
HOSW12A	1790	1103	1120	943	1195	827	1110	1255	897	1210	840
HOSW12A	1800	1013	1079	1051	976	988	1115	1023	959	1161	930
HOSW12A	1810	873	808	785	-9999						
HOSW14A	1742	733	865	1062	1820	1843	1701	955	903		
HOSW14A	1750	1120	1440	1854	1927	1691	1321	2046	2316	1629	1674
HOSW14A	1760	1632	1320	1067	1366	1427	1185	1116	968	1415	1153
HOSW14A	1770	1290	1288	1195	1260	560	1083	1621	1504	1980	2647
HOSW14A	1780	2050	1883	1316	1512	1345	1270	1177	1314	1177	1121
HOSW14A	1790	1136	1112	746	1161	1342	1209	1766	1148	1379	1097
HOSW14A	1800	835	-9999								

Appendix 2.

Complete COFECHA output for the 37 series sampled from Hoskins House, Greensboro, North Carolina.

```
---------------------------------------------------------------------------------------------------------------------------------

QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series:   hoskins.rwl

CONTENTS:

   Part 1:  Title page, options selected, summary, absent rings by series
   Part 2:  Histogram of time spans
   Part 3:  Master series with sample depth and absent rings by year
   Part 4:  Bar plot of Master Dating Series
   Part 5:  Correlation by segment of each series with Master
   Part 6:  Potential problems: low correlation, divergent year-to-year changes, absent rings, outliers
   Part 7:  Descriptive statistics

RUN CONTROL OPTIONS SELECTED                             VALUE

        1  Cubic smoothing spline 50% wavelength cutoff for filtering
                                                           32 years
        2  Segments examined are                           40 years lagged successively by  20 years
        3  Autoregressive model applied                     A  Residuals are used in master dating series and testing
        4  Series transformed to logarithms                 Y  Each series log-transformed for master dating series and testing
        5  CORRELATION is Pearson (parametric, quantitative)
           Critical correlation, 99% confidence level   .3665
        6  Master dating series saved                       N
        7  Ring measurements listed                         N
        8  Parts printed                              1234567
        9  Absent rings are omitted from master series and segment correlations  (Y)

Time span of Master dating series is  1723 to  1831   109 years
Continuous time span is               1723 to  1831   109 years
Portion with two or more series is    1727 to  1813    87 years

                                       ****************************************
                                       *C* Number of dated series        37 *C*
                                       *O* Master series 1723 1831  109 yrs *O*
                                       *F* Total rings in all series   2263 *F*
                                       *E* Total dated rings checked   2241 *E*
                                       *C* Series intercorrelation     .647 *C*
                                       *H* Average mean sensitivity    .207 *H*
                                       *A* Segments, possible problems    8 *A*
                                       *** Mean length of series       61.2 ***
                                       ****************************************

ABSENT RINGS listed by SERIES:            (See Master Dating Series for absent rings listed by year)

              No ring measurements of zero value
```

```
PART 2:  TIME PLOT OF TREE-RING SERIES:                                                        13:50  Tue 11 Apr 2006  Page   2
-------------------------------------------------------------------------------------------------------------------------------------
                                                                                                                 Beg  End
1000      1100      1200      1300      1400      1500      1600      1700      1800      1900      2000 Ident   Seq year year  Yrs
  :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    :    : --------- --- ---- ---- ----
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <====>    .    .    .    . HOSN03A    1 1755 1800   46
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSN03B    2 1754 1813   60
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<===>    .    .    .    . H0SN04A    3 1763 1803   41
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSN06B    4 1761 1810   50
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <====> .    .    .    .    . HOSN07A    5 1735 1785   51
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <===>.    .    .    .    . HOSN08A    6 1750 1796   47
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSN08B    7 1749 1813   65
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSN09A    8 1759 1812   54
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<===>    .    .    .    . HOSN09B    9 1767 1807   41
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSN11A   10 1743 1812   70
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <=======>   .    .    .    . HOSN12B   11 1736 1813   78
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    . <========>   .    .    .    . HOSE04B   12 1723 1811   89
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <=======>   .    .    .    . HOSE05A   13 1732 1812   81
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    . <==>    .    .    .    . HOSE07A   14 1772 1807   36
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <======>    .    .    .    . HOSE08A   15 1739 1805   67
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSE08B   16 1751 1812   62
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSE09A   17 1755 1812   58
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<==>.    .    .    .    . HOSE10B   18 1761 1797   37
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSS03A   19 1761 1813   53
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <=======>   .    .    .    . HOSS05A   20 1733 1813   81
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .  <=====>.    .    .    .    . HOSS05B   21 1733 1795   63
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSS06A   22 1742 1812   71
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <====>    .    .    .    . HOSS06B   23 1752 1802   51
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSS07A   24 1745 1812   68
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSS07B   25 1752 1812   61
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSS08A   26 1760 1812   53
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <=====>    .    .    .    . HOSS09A   27 1749 1806   58
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSS09B   28 1744 1811   68
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSW06A   29 1760 1812   53
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    . <===========> .    .    .    . HOSW06B   30 1727 1831  105
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSW06C   31 1760 1812   53
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSW07C   32 1747 1813   67
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    <=====>   .    .    .    . HOSW09A   33 1750 1813   64
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .<====>   .    .    .    . HOSW10A   34 1763 1812   50
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <======>   .    .    .    . HOSW11A   35 1745 1811   67
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    . <========>   .    .    .    . HOSW12A   36 1728 1812   85
  .    .    .    .    .    .    .    .    .    .    .    .    .    .    .   <=====>    .    .    .    . HOSW14A   37 1742 1800   59
```

Year	Value	No Ab	Year	Value	No Ab	Year	Value	No Ab
			1750	.370	20	1800	.009	33
			1751	.712	21	1801	-.663	31
			1752	.456	23	1802	.356	31
			1753	1.118	23	1803	-.427	30
			1754	.903	24	1804	.791	29
			1755	-2.638	26	1805	-.247	29
			1756	-.360	26	1806	-1.176	28
			1757	.294	26	1807	.062	27
			1758	-1.157	26	1808	.910	25
			1759	-.437	27	1809	.343	25
			1760	.435	30	1810	.825	25
			1761	.467	33	1811	-.240	24
			1762	-.619	33	1812	-.595	21
			1763	-.180	35	1813	-.243	8
			1764	.057	35	1814	1.110	1
			1765	.495	35	1815	-.111	1
			1766	.453	35	1816	.406	1
			1767	-.619	36	1817	-2.579	1
			1768	1.552	36	1818	.180	1
			1769	.770	36	1819	2.753	1
			1770	1.127	36	1820	1.948	1
			1771	1.189	36	1821	-.172	1
			1772	.300	37	1822	.335	1
1723	1.846	1	1773	.207	37	1823	-1.014	1
1724	.101	1	1774	-2.757	37	1824	-2.286	1
1725	-.218	1	1775	-1.891	37	1825	2.366	1
1726	-1.886	1	1776	-.686	37	1826	-.274	1
1727	.639	2	1777	-.599	37	1827	.133	1
1728	.932	3	1778	-.989	37	1828	1.099	1
1729	.741	3	1779	-1.435	37	1829	.564	1
1730	-1.353	3	1780	-.183	37	1830	-1.105	1
1731	-.354	3	1781	.518	37	1831	-1.125	1
1732	-.621	4	1782	.061	37			
1733	-.520	6	1783	.071	37			
1734	.211	6	1784	.154	37			
1735	.330	7	1785	.012	37			
1736	-.303	8	1786	.856	36			
1737	.314	8	1787	.540	36			
1738	.246	8	1788	.616	36			
1739	.366	9	1789	.871	36			
1740	.017	9	1790	-.292	36			
1741	-1.087	9	1791	.088	36			
1742	-.350	11	1792	-.482	36			
1743	-1.082	12	1793	1.246	36			
1744	-.453	13	1794	.384	36			
1745	.691	15	1795	1.200	36			
1746	.122	15	1796	1.441	35			
1747	.885	16	1797	-1.739	34			
1748	-1.022	16	1798	-.028	33			
1749	.469	18	1799	-2.469	33			

```
PART 4:  Master Bar Plot:                                                                              13:50  Tue 11 Apr 2006  Page   4
-----------------------------------------------------------------------------------------------------------------------------------
  Year Rel value  Year Rel value  Year Rel value  Year Rel value  Year Rel value  Year Rel value  Year Rel value  Year Rel value
                                                  1750------A     1800----@
                                                  1751--------C   1801--c
                                                  1752-------B    1802------A
                                                  1753---------D  1803---b
                                                  1754---------D  1804--------C
                                                  1755k           1805---a
                                                  1756---a        1806-e
                                                  1757------A     1807-----@
                                                  1758-e          1808---------D
                                                  1759---b        1809------A
                                                  1760-------B    1810---------C
                                                  1761-------B    1811---a
                                                  1762--b         1812--b
                                                  1763---a        1813---a
                                                  1764-----@      1814---------D
                                                  1765-------B    1815----@
                                                  1766-------B    1816-------B
                                                  1767--b         1817j
                                                  1768----------F 1818-----A
                                                  1769--------C   1819----------K
                                                  1770---------E  1820----------H
                                                  1771---------E  1821---a
                                                  1772------A     1822------A
                                  1723----------G 1773-----A      1823-d
                                  1724-----@      1774k           1824i
                                  1725---a        1775h           1825----------I
                                  1726h           1776--c         1826---a
                                  1727--------C   1777--b         1827-----A
                                  1728---------D  1778-d          1828---------D
                                  1729--------C   1779-f          1829-------B
                                  1730-e          1780---a        1830-d
                                  1731---a        1781-------B    1831-d
                                  1732--b         1782-----@
                                  1733--b         1783-----@
                                  1734------A     1784-----A
                                  1735------A     1785----@
                                  1736---a        1786---------C
                                  1737------A     1787-------B
                                  1738------A     1788--------B
                                  1739------A     1789---------C
                                  1740----@       1790---a
                                  1741-d          1791-----@
                                  1742---a        1792--b
                                  1743-d          1793----------E
                                  1744--b         1794-------B
                                  1745--------C   1795---------E
                                  1746-----@      1796----------F
                                  1747---------D  1797g
                                  1748-d          1798----@
                                  1749-------B    1799j
```

Correlations of 40-year dated segments, lagged 20 years
Flags: A = correlation under .3665 but highest as dated; B = correlation higher at other than dated position

Seq	Series	Time_span		1720 1759	1740 1779	1760 1799	1780 1819
1	HOSN03A	1755	1800		.82	.86	.86
2	HOSN03B	1754	1813		.88	.79	.71
3	H0SN04A	1763	1803			.75	.74
4	HOSN06B	1761	1810			.70	.61
5	HOSN07A	1735	1785	.62	.67	.73	
6	HOSN08A	1750	1796		.68	.75	
7	HOSN08B	1749	1813		.73	.85	.82
8	HOSN09A	1759	1812		.80	.83	.78
9	HOSN09B	1767	1807			.86	.86
10	HOSN11A	1743	1812		.79	.75	.73
11	HOSN12B	1736	1813	.73	.75	.73	.67
12	HOSE04B	1723	1811	.67	.83	.60	.45
13	HOSE05A	1732	1812	.73	.72	.69	.63
14	HOSE07A	1772	1807			.70	
15	HOSE08A	1739	1805	.84	.80	.56	.55
16	HOSE08B	1751	1812		.80	.58	.59
17	HOSE09A	1755	1812		.72	.83	.81
18	HOSE10B	1761	1797			.66	
19	HOSS03A	1761	1813			.82	.84
20	HOSS05A	1733	1813	.33B	.62	.64	.65
21	HOSS05B	1733	1795	.43B	.68	.66	
22	HOSS06A	1742	1812		.84	.75	.66
23	HOSS06B	1752	1802		.79	.78	.78
24	HOSS07A	1745	1812		.31B	.63	.48
25	HOSS07B	1752	1812		.23B	.62	.58
26	HOSS08A	1760	1812			.78	.79
27	HOSS09A	1749	1806		.76	.73	.71
28	HOSS09B	1744	1811		.83	.75	.72
29	HOSW06A	1760	1812			.87	.82
30	HOSW06B	1727	1831	.47	.54	.09B	.19B
31	HOSW06C	1760	1812			.82	.82
32	HOSW07C	1747	1813		.74	.70	.64
33	HOSW09A	1750	1813		.42	.74	.68
34	HOSW10A	1763	1812			.83	.78
35	HOSW11A	1745	1811		.30B	.38	.31B
36	HOSW12A	1728	1812	.72	.71	.62	.56
37	HOSW14A	1742	1800		.53	.51	.48
Av segment correlation				.62	.68	.70	.67

```
-------------------------------------------------------------------------------------------------------------------------------------

For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged  40-year segments of series filtered with  32-year spline,
    at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year
=====================================================================================================================================

HOSN03A   1755 to  1800      46 years                                                                                    Series   1

[B] Entire series, effect on correlation (  .835) is:
      Lower   1755  -.016   1794  -.011   1763  -.009   1796  -.008  Higher   1774   .037   1797   .012   1799   .011   1786   .003

=====================================================================================================================================

HOSN03B   1754 to  1813      60 years                                                                                    Series   2

[B] Entire series, effect on correlation (  .751) is:
      Lower   1796  -.052   1806  -.023   1813  -.017   1794  -.017  Higher   1774   .058   1755   .047   1797   .036   1799   .017

=====================================================================================================================================

H0SN04A   1763 to  1803      41 years                                                                                    Series   3

[B] Entire series, effect on correlation (  .741) is:
      Lower   1767  -.030   1782  -.023   1779  -.021   1790  -.012  Higher   1797   .080   1774   .023   1799   .018   1793   .007

=====================================================================================================================================

HOSN06B   1761 to  1810      50 years                                                                                    Series   4

[B] Entire series, effect on correlation (  .609) is:
      Lower   1809  -.069   1806  -.021   1771  -.016   1764  -.014  Higher   1797   .076   1799   .030   1768   .026   1793   .017

=====================================================================================================================================

HOSN07A   1735 to  1785      51 years                                                                                    Series   5

[B] Entire series, effect on correlation (  .585) is:
      Lower   1745  -.051   1738  -.048   1748  -.026   1775  -.018  Higher   1774   .083   1755   .082   1768   .021   1758   .013

=====================================================================================================================================

HOSN08A   1750 to  1796      47 years                                                                                    Series   6
```

```
[B] Entire series, effect on correlation (  .656) is:
      Lower   1755  -.065   1754  -.031   1775  -.026   1793  -.019  Higher   1774   .171   1768   .017   1779   .010   1753   .007

====================================================================================================================================

HOSN08B   1749 to  1813      65 years                                                                                    Series   7

[B] Entire series, effect on correlation (  .750) is:
      Lower   1755  -.027   1754  -.027   1809  -.019   1793  -.013  Higher   1774   .056   1799   .031   1797   .012   1768   .007

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1809 +3.0 SD
====================================================================================================================================

HOSN09A   1759 to  1812      54 years                                                                                    Series   8

[B] Entire series, effect on correlation (  .748) is:
      Lower   1804  -.027   1759  -.022   1808  -.017   1763  -.009  Higher   1797   .070   1768   .012   1799   .007   1793   .006

====================================================================================================================================

HOSN09B   1767 to  1807      41 years                                                                                    Series   9

[B] Entire series, effect on correlation (  .863) is:
      Lower   1774  -.016   1776  -.010   1803  -.009   1787  -.007  Higher   1797   .013   1793   .006   1768   .006   1795   .003

====================================================================================================================================

HOSN11A   1743 to  1812      70 years                                                                                    Series  10

[B] Entire series, effect on correlation (  .745) is:
      Lower   1797  -.024   1781  -.021   1750  -.016   1747  -.011  Higher   1774   .049   1755   .032   1799   .013   1768   .006

====================================================================================================================================

HOSN12B   1736 to  1813      78 years                                                                                    Series  11

[B] Entire series, effect on correlation (  .692) is:
      Lower   1797  -.028   1752  -.023   1774  -.018   1739  -.015  Higher   1755   .087   1799   .019   1768   .008   1795   .005

====================================================================================================================================

HOSE04B   1723 to  1811      89 years                                                                                    Series  12

[*] Early part of series cannot be checked from 1723 to 1726 -- not matched by another series

[B] Entire series, effect on correlation (  .568) is:
      Lower   1797  -.044   1800  -.028   1739  -.018   1799  -.016  Higher   1755   .129   1774   .049   1768   .016   1793   .009

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1739 +3.6 SD
====================================================================================================================================

HOSE05A   1732 to  1812      81 years                                                                                    Series  13
```

```
[B] Entire series, effect on correlation (  .667) is:
      Lower   1753  -.030   1774  -.026   1807  -.022   1781  -.018  Higher   1755   .090   1799   .026   1797   .011   1768   .008

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1796 +3.6 SD
==================================================================================================================================

HOSE07A   1772 to  1807      36 years                                                                                    Series  14

[B] Entire series, effect on correlation (  .704) is:
      Lower   1774  -.054   1806  -.033   1805  -.020   1788  -.009  Higher   1797   .097   1799   .021   1793   .012   1795   .011

==================================================================================================================================

HOSE08A   1739 to  1805      67 years                                                                                    Series  15

[B] Entire series, effect on correlation (  .644) is:
      Lower   1794  -.048   1797  -.039   1796  -.029   1789  -.023  Higher   1755   .073   1774   .046   1799   .026   1793   .010

==================================================================================================================================

HOSE08B   1751 to  1812      62 years                                                                                    Series  16

[B] Entire series, effect on correlation (  .708) is:
      Lower   1797  -.046   1793  -.016   1763  -.013   1805  -.010  Higher   1755   .097   1799   .020   1768   .009   1758   .006

==================================================================================================================================

HOSE09A   1755 to  1812      58 years                                                                                    Series  17

[B] Entire series, effect on correlation (  .759) is:
      Lower   1761  -.020   1759  -.018   1755  -.014   1804  -.014  Higher   1797   .041   1774   .025   1799   .013   1793   .006

==================================================================================================================================

HOSE10B   1761 to  1797      37 years                                                                                    Series  18

[B] Entire series, effect on correlation (  .655) is:
      Lower   1771  -.055   1775  -.046   1778  -.023   1762  -.022  Higher   1797   .167   1774   .072   1768   .013   1779   .013

[E] Outliers     2   3.0 SD above or -4.5 SD below mean for year
      1775 +3.1 SD;    1797 -4.5 SD
==================================================================================================================================

HOSS03A   1761 to  1813      53 years                                                                                    Series  19

[B] Entire series, effect on correlation (  .787) is:
      Lower   1813  -.028   1761  -.026   1788  -.010   1765  -.010  Higher   1797   .058   1799   .040   1768   .006   1775   .004

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1813 +3.0 SD
==================================================================================================================================
```

```
HOSS05A   1733 to  1813      81 years                                                                                    Series  20

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
   1733 1772   -7   -.08  .01 -.14  .47*-.01  .01  .23  .00 -.16 -.11  .33|-.04  .03  .01  .01 -.04 -.41  .12 -.21 -.14 -.22

[B] Entire series, effect on correlation (  .491) is:
      Lower   1739  -.080   1762  -.022   1812  -.017   1785  -.010  Higher   1774   .052   1799   .021   1793   .013   1797   .013
    1733 to 1772 segment:
      Lower   1739  -.138   1760  -.009   1740  -.008   1735  -.007  Higher   1768   .016   1743   .016   1755   .015   1767   .015

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1812 +3.4 SD
==================================================================================================================================

HOSS05B   1733 to  1795      63 years                                                                                    Series  21

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
   1733 1772    7    .00  .01 -.16  .01 -.19  .17  .13  .05 -.01 -.20  .43|-.25  .06  .05  .00  .08 -.10  .50*-.32 -.21 -.31

[B] Entire series, effect on correlation (  .540) is:
      Lower   1787  -.033   1734  -.028   1755  -.027   1733  -.025  Higher   1774   .126   1793   .019   1748   .019   1775   .012
    1733 to 1772 segment:
      Lower   1734  -.051   1733  -.039   1760  -.029   1740  -.016  Higher   1748   .045   1758   .020   1743   .020   1767   .015

==================================================================================================================================

HOSS06A   1742 to  1812      71 years                                                                                    Series  22

[B] Entire series, effect on correlation (  .752) is:
      Lower   1805  -.025   1756  -.013   1787  -.011   1786  -.010  Higher   1755   .070   1774   .010   1806   .005   1795   .004

==================================================================================================================================

HOSS06B   1752 to  1802      51 years                                                                                    Series  23

[B] Entire series, effect on correlation (  .826) is:
      Lower   1781  -.057   1782  -.011   1785  -.006   1763  -.006  Higher   1755   .038   1774   .034   1799   .024   1797   .007

==================================================================================================================================

HOSS07A   1745 to  1812      68 years                                                                                    Series  24

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
   1745 1784   -8   -.22  .13  .36* .24 -.13  .16  .33 -.05  .02  .16  .31|-.15 -.30 -.09 -.28 -.37 -.23  .24 -.15 -.19  .26

[B] Entire series, effect on correlation (  .433) is:
      Lower   1806  -.068   1755  -.051   1745  -.017   1758  -.011  Higher   1797   .042   1799   .023   1748   .017   1768   .014
    1745 to 1784 segment:
      Lower   1755  -.060   1745  -.040   1758  -.021   1781  -.021  Higher   1748   .048   1768   .044   1774   .035   1753   .027

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
```

```
      1755 +4.9 SD
==================================================================================================================================

HOSS07B   1752 to  1812      61 years                                                                                    Series  25

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
   1752 1791   -5    .11  .07  .24 -.17 -.19  .31* .08  .18  .02 -.01  .23|-.18 -.01 -.15 -.18 -.04 -.35  .16 -.16  .14  .22

[B] Entire series, effect on correlation (  .405) is:
      Lower   1755  -.137   1753  -.021   1806  -.020   1787  -.019  Higher   1799   .048   1774   .021   1786   .012   1795   .012
    1752 to 1791 segment:
      Lower   1755  -.227   1753  -.038   1787  -.033   1763  -.016  Higher   1774   .100   1786   .036   1771   .019   1758   .018

[E] Outliers     2   3.0 SD above or -4.5 SD below mean for year
      1755 +5.4 SD;    1786 +3.5 SD
==================================================================================================================================

HOSS08A   1760 to  1812      53 years                                                                                    Series  26

[B] Entire series, effect on correlation (  .752) is:
      Lower   1799  -.027   1779  -.019   1761  -.018   1767  -.009  Higher   1797   .070   1774   .066   1775   .005   1796   .005

==================================================================================================================================

HOSS09A   1749 to  1806      58 years                                                                                    Series  27

[B] Entire series, effect on correlation (  .724) is:
      Lower   1780  -.022   1779  -.013   1798  -.011   1799  -.011  Higher   1774   .056   1797   .022   1755   .014   1768   .010

==================================================================================================================================

HOSS09B   1744 to  1811      68 years                                                                                    Series  28

[B] Entire series, effect on correlation (  .758) is:
      Lower   1798  -.021   1799  -.015   1780  -.011   1811  -.008  Higher   1774   .036   1755   .025   1797   .012   1768   .009

==================================================================================================================================

HOSW06A   1760 to  1812      53 years                                                                                    Series  29

[B] Entire series, effect on correlation (  .805) is:
      Lower   1809  -.031   1806  -.017   1810  -.012   1774  -.011  Higher   1797   .051   1799   .029   1768   .006   1793   .005

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1809 +3.1 SD
==================================================================================================================================

HOSW06B   1727 to  1831     105 years                                                                                    Series  30

[*] Later part of series cannot be checked from 1814 to 1831 -- not matched by another series

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
```

```
   1760 1799  -10    .32*-.03 -.21  .06  .04 -.09 -.39 -.14 -.10  .31  .09|-.04 -.02 -.13  .08  .01  .24 -.05  .17  .13 -.14
   1774 1813    6    .20  .06 -.08  .01  .15 -.05 -.17 -.34 -.13  .15  .19|-.12 -.05 -.05 -.12 -.04  .30* .02  .18 -.04 -.20

[B] Entire series, effect on correlation (  .293) is:
      Lower   1730  -.041   1799  -.036   1778  -.019   1768  -.019  Higher   1755   .223   1774   .049   1796   .010   1806   .009
    1760 to 1799 segment:
      Lower   1799  -.056   1770  -.038   1768  -.038   1778  -.036  Higher   1774   .193   1796   .028   1779   .023   1793   .013
    1774 to 1813 segment:
      Lower   1799  -.074   1778  -.040   1784  -.034   1791  -.032  Higher   1774   .151   1796   .031   1804   .027   1806   .021

[E] Outliers     4   3.0 SD above or -4.5 SD below mean for year
      1730 +4.3 SD;    1755 -4.6 SD;    1778 +4.3 SD;    1799 +3.7 SD
==================================================================================================================================

HOSW06C   1760 to  1812      53 years                                                                                    Series  31

[B] Entire series, effect on correlation (  .777) is:
      Lower   1806  -.020   1760  -.017   1809  -.017   1763  -.010  Higher   1797   .059   1768   .010   1774   .009   1799   .008

==================================================================================================================================

HOSW07C   1747 to  1813      67 years                                                                                    Series  32

[B] Entire series, effect on correlation (  .723) is:
      Lower   1774  -.027   1813  -.024   1783  -.014   1810  -.011  Higher   1755   .083   1799   .011   1793   .008   1797   .006

==================================================================================================================================

HOSW09A   1750 to  1813      64 years                                                                                    Series  33

[B] Entire series, effect on correlation (  .548) is:
      Lower   1755  -.074   1754  -.030   1813  -.022   1757  -.021  Higher   1799   .074   1797   .015   1793   .014   1806   .011

[E] Outliers     1   3.0 SD above or -4.5 SD below mean for year
      1813 +3.6 SD
==================================================================================================================================

HOSW10A   1763 to  1812      50 years                                                                                    Series  34

[B] Entire series, effect on correlation (  .793) is:
      Lower   1806  -.016   1773  -.012   1774  -.007   1782  -.005  Higher   1799   .042   1797   .030   1793   .008   1768   .008

==================================================================================================================================

HOSW11A   1745 to  1811      67 years                                                                                    Series  35

[A] Segment   High   -10   -9   -8   -7   -6   -5   -4   -3   -2   -1   +0   +1   +2   +3   +4   +5   +6   +7   +8   +9  +10
   ---------  ----   ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---  ---
   1745 1784    4   -.38 -.32 -.02 -.10 -.05 -.11  .00 -.06 -.13  .02  .30| .43 -.01  .10  .43*-.22 -.23  .24 -.03 -.10 -.26
   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
   1772 1811   -2   -.14 -.15 -.07 -.06 -.11  .10 -.15 -.19  .33*-.09  .31|-.13  .30 -.05  .31 -.10  .19  .08 -.35 -.15  .03

[B] Entire series, effect on correlation (  .310) is:
      Lower   1754  -.055   1797  -.027   1806  -.020   1795  -.020  Higher   1799   .130   1768   .022   1748   .017   1755   .014
```

```
    1745 to 1784 segment:
      Lower   1754  -.129   1771  -.039   1770  -.033   1774  -.014  Higher   1768   .045   1755   .043   1748   .034   1753   .027
    1772 to 1811 segment:
      Lower   1797  -.046   1795  -.035   1806  -.030   1801  -.027  Higher   1799   .236   1789   .012   1796   .012   1775   .011

[E] Outliers     2   3.0 SD above or -4.5 SD below mean for year
      1754 -4.8 SD;    1801 +3.7 SD
==================================================================================================================================

HOSW12A   1728 to  1812      85 years                                                                                   Series  36

[B] Entire series, effect on correlation (  .613) is:
      Lower   1771  -.021   1739  -.020   1781  -.015   1805  -.012  Higher   1755   .115   1799   .025   1768   .013   1774   .010

[E] Outliers     2   3.0 SD above or -4.5 SD below mean for year
      1739 +3.3 SD;    1755 -4.8 SD
==================================================================================================================================

HOSW14A   1742 to  1800      59 years                                                                                   Series  37

[B] Entire series, effect on correlation (  .470) is:
      Lower   1779  -.048   1800  -.023   1755  -.022   1792  -.019  Higher   1774   .155   1797   .021   1748   .015   1796   .013

[E] Outliers     2   3.0 SD above or -4.5 SD below mean for year
      1778 +3.1 SD;    1779 +5.3 SD
==================================================================================================================================
```

						Corr	//-------- Unfiltered --------\\				//---- Filtered -----\\				
			No.	No.	No.	with	Mean	Max	Std	Auto	Mean	Max	Std	Auto	AR
Seq	Series	Interval	Years	Segmt	Flags	Master	msmt	msmt	dev	corr	sens	value	dev	corr	()
1	HOSN03A	1755 1800	46	3	0	.835	1.85	3.18	.559	.510	.253	2.53	.482	-.011	1
2	HOSN03B	1754 1813	60	3	0	.751	1.80	3.46	.555	.467	.250	2.50	.508	-.072	1
3	H0SN04A	1763 1803	41	2	0	.741	2.23	4.01	.820	.832	.172	2.44	.565	-.043	2
4	HOSN06B	1761 1810	50	2	0	.609	1.96	4.66	.950	.665	.275	3.14	.638	-.151	1
5	HOSN07A	1735 1785	51	3	0	.585	1.24	2.46	.384	.556	.210	2.75	.699	-.081	1
6	HOSN08A	1750 1796	47	2	0	.656	1.91	3.34	.559	.494	.222	2.62	.400	-.050	1
7	HOSN08B	1749 1813	65	3	0	.750	1.72	3.38	.570	.609	.228	2.66	.471	-.085	1
8	HOSN09A	1759 1812	54	3	0	.748	2.42	4.49	.761	.585	.190	2.51	.420	-.053	1
9	HOSN09B	1767 1807	41	2	0	.863	2.18	4.06	.674	.552	.208	2.47	.447	-.052	1
10	HOSN11A	1743 1812	70	3	0	.745	1.49	2.68	.408	.507	.197	2.56	.551	-.055	1
11	HOSN12B	1736 1813	78	4	0	.692	1.19	2.10	.432	.566	.225	2.38	.328	-.068	1
12	HOSE04B	1723 1811	89	4	0	.568	1.28	3.06	.393	.545	.194	2.57	.359	.013	1
13	HOSE05A	1732 1812	81	4	0	.667	1.54	3.45	.463	.595	.202	2.94	.424	-.061	1
14	HOSE07A	1772 1807	36	1	0	.704	1.62	2.62	.545	.601	.232	2.44	.453	.009	1
15	HOSE08A	1739 1805	67	4	0	.644	1.21	2.76	.413	.607	.203	2.65	.583	-.027	1
16	HOSE08B	1751 1812	62	3	0	.708	1.40	2.45	.397	.559	.205	2.46	.398	-.033	1
17	HOSE09A	1755 1812	58	3	0	.759	1.68	3.13	.527	.677	.195	2.55	.448	-.074	1
18	HOSE10B	1761 1797	37	1	0	.655	2.16	3.30	.718	.395	.325	2.42	.473	.012	1
19	HOSS03A	1761 1813	53	2	0	.787	1.90	3.47	.596	.665	.196	2.55	.510	-.048	1
20	HOSS05A	1733 1813	81	4	1	.491	1.22	2.99	.630	.834	.202	2.87	.500	-.005	1
21	HOSS05B	1733 1795	63	3	1	.540	1.39	2.60	.578	.789	.199	2.78	.522	.003	1
22	HOSS06A	1742 1812	71	3	0	.752	1.83	3.54	.548	.539	.224	2.60	.441	.023	1
23	HOSS06B	1752 1802	51	3	0	.826	1.72	3.03	.550	.625	.243	2.50	.597	-.072	1
24	HOSS07A	1745 1812	68	3	1	.433	1.78	4.27	.900	.924	.124	2.34	.338	-.038	1
25	HOSS07B	1752 1812	61	3	1	.405	1.85	5.00	.897	.750	.177	2.77	.407	-.074	2
26	HOSS08A	1760 1812	53	2	0	.752	1.75	4.17	.845	.808	.199	2.62	.478	-.070	1
27	HOSS09A	1749 1806	58	3	0	.724	1.76	2.56	.431	.480	.197	2.41	.374	.020	1
28	HOSS09B	1744 1811	68	3	0	.758	1.85	3.05	.507	.549	.212	2.43	.351	.059	2
29	HOSW06A	1760 1812	53	2	0	.805	2.20	3.58	.684	.618	.222	2.69	.446	-.020	1
30	HOSW06B	1727 1831	105	4	2	.293	1.06	3.22	.464	.791	.207	2.48	.326	-.014	1
31	HOSW06C	1760 1812	53	2	0	.777	1.99	3.14	.651	.738	.184	2.48	.428	-.011	1
32	HOSW07C	1747 1813	67	3	0	.723	1.53	2.39	.282	.385	.163	2.52	.364	-.037	1
33	HOSW09A	1750 1813	64	3	0	.548	1.58	4.51	.752	.778	.176	2.52	.419	-.037	1
34	HOSW10A	1763 1812	50	2	0	.793	1.72	2.92	.466	.671	.174	2.63	.552	.075	1
35	HOSW11A	1745 1811	67	3	2	.310	1.04	2.55	.500	.793	.203	2.55	.429	-.070	1
36	HOSW12A	1728 1812	85	4	0	.613	1.22	2.87	.447	.592	.239	2.56	.340	-.017	1
37	HOSW14A	1742 1800	59	3	0	.470	1.37	2.65	.401	.595	.207	2.65	.423	-.036	1
Total or mean:			2263	105	8	.647	1.61	5.00	.560	.633	.207	3.14	.447	-.033	

- = [COFECHA TEST COF] = -