[] Dendrochronology Program Library Run BB Program COF 11:39 Thu 18 Jan 2018 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30335

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: BB\_TSCA\_corr1-50

File of DATED series: BB\_TSCA\_corr1.txt

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 50 years lagged successively by 25 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 .3281

6 Master dating series saved N

7 Ring measurements listed Y

8 Parts printed 1234567

9 Absent rings are omitted from master series and segment correlations (Y)

Time span of Master dating series is 1798 to 2016 219 years

Continuous time span is 1798 to 2016 219 years

Portion with two or more series is 1811 to 2016 206 years

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*C\* Number of dated series 32 \*C\*

\*O\* Master series 1798 2016 219 yrs \*O\*

\*F\* Total rings in all series 5320 \*F\*

\*E\* Total dated rings checked 5307 \*E\*

\*C\* Series intercorrelation .732 \*C\*

\*H\* Average mean sensitivity .251 \*H\*

\*A\* Segments, possible problems 0 \*A\*

\*\*\* Mean length of series 166.3 \*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

1143B 1 absent rings: 1965

1402A 1 absent rings: 2011

1402B 3 absent rings: 2011 2015 2016

5 absent rings .094%

PART 2: TIME PLOT OF TREE-RING SERIES: BB\_TSCA\_corr1-50 11:39 Thu 18 Jan 2018 Page 2

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 Ident Seq Time-span Yrs

: : : : : : : : : : : : : : : : : : : : : -------- --- ---- ---- ----

. . . . . . . . . . . . . . . . . <==========> . 1139A 1 1904 2016 113

. . . . . . . . . . . . . . . . . <============> . 1139B 2 1883 2016 134

. . . . . . . . . . . . . . . . .<==============> . 1140A 3 1862 2016 155

. . . . . . . . . . . . . . . . <=================> . 1140B 4 1835 2016 182

. . . . . . . . . . . . . . . . <=================> . 1141A 5 1838 2016 179

. . . . . . . . . . . . . . . . <================> . 1141B 6 1847 2016 170

. . . . . . . . . . . . . . . . <================> . 1142A 7 1845 2016 172

. . . . . . . . . . . . . . . . <===============> . 1142B 8 1853 2016 164

. . . . . . . . . . . . . . . . <=================> . 1143A 9 1839 2016 178

. . . . . . . . . . . . . . . . <=================> . 1143B 10 1837 2016 180

. . . . . . . . . . . . . . . . <==================> . 1144A 11 1826 2016 191

. . . . . . . . . . . . . . . . <=================> . 1144B 12 1831 2016 186

. . . . . . . . . . . . . . . . . <=============> . 1145A 13 1876 2016 141

. . . . . . . . . . . . . . . . . <=============> . 1145B 14 1879 2016 138

. . . . . . . . . . . . . . . . . <============> . 1146A 15 1883 2016 134

. . . . . . . . . . . . . . . . . . <========> . 1146B 16 1927 2016 90

. . . . . . . . . . . . . . . . <=================> . 1401A 17 1838 2016 179

. . . . . . . . . . . . . . . .<===================> . 1401B 18 1816 2016 201

. . . . . . . . . . . . . . . . <==================> . 1402A 19 1826 2016 191

. . . . . . . . . . . . . . . <=====================> . 1402B 20 1798 2016 219

. . . . . . . . . . . . . . . . . .<=========> . 1403A 21 1919 2016 98

. . . . . . . . . . . . . . . . . <==========> . 1403B 22 1905 2016 112

. . . . . . . . . . . . . . . . <===============> . 1404A 23 1852 2016 165

. . . . . . . . . . . . . . . . <==================> . 1404B 24 1825 2016 192

. . . . . . . . . . . . . . . . <==================> . 1405A 25 1828 2016 189

. . . . . . . . . . . . . . . . <==================> . 1405B 26 1826 2016 191

. . . . . . . . . . . . . . . . .<==============> . 1406A 27 1865 2016 152

. . . . . . . . . . . . . . . . .<==============> . 1406B 28 1861 2016 156

. . . . . . . . . . . . . . . . <==================> . 1407A 29 1822 2016 195

. . . . . . . . . . . . . . . . <===============> . 1407B 30 1856 2016 161

. . . . . . . . . . . . . . . .<===================> . 1408A 31 1811 2016 206

. . . . . . . . . . . . . . . .<===================> . 1408B 32 1811 2016 206

: : : : : : : : : : : : : : : : : : : : :

1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050

PART 3: Master Dating Series: BB\_TSCA\_corr1-50 11:39 Thu 18 Jan 2018 Page 3

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Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab

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1800 .499 1 1850 .469 18 1900 -.774 28 1950 -2.016 32 2000 -.371 32

1801 -3.229 1 1851 -.102 18 1901 .247 28 1951 .560 32 2001 .510 32

1802 1.408 1 1852 -1.843 19 1902 1.147 28 1952 -.128 32 2002 -.382 32

1803 2.535 1 1853 -.536 20 1903 1.076 28 1953 .090 32 2003 -1.576 32

1804 -1.025 1 1854 -1.323 20 1904 .202 29 1954 .410 32 2004 -.649 32

1805 .654 1 1855 -.119 20 1905 1.378 30 1955 .796 32 2005 1.290 32

1806 .291 1 1856 -1.787 21 1906 1.124 30 1956 .243 32 2006 -.004 32

1807 .414 1 1857 -.072 21 1907 .481 30 1957 1.645 32 2007 .140 32

1808 -.621 1 1858 -.453 21 1908 -.733 30 1958 -.079 32 2008 -.269 32

1809 1.620 1 1859 -1.082 21 1909 -1.058 30 1959 -.504 32 2009 1.457 32

1810 -.488 1 1860 -.270 21 1910 -.492 30 1960 -.882 32 2010 1.569 32

1811 -.391 3 1861 1.151 22 1911 -2.384 30 1961 1.237 32 2011 -.749 32 2

1812 .434 3 1862 1.127 23 1912 -1.774 30 1962 -.709 32 2012 .405 32

1813 .599 3 1863 2.111 23 1913 -.196 30 1963 .308 32 2013 .853 32

1814 1.238 3 1864 .767 23 1914 -.042 30 1964 -.386 32 2014 -.214 32

1815 1.342 3 1865 1.274 24 1915 1.372 30 1965 -2.364 32 1 2015 -.673 32 1

1816 -1.314 4 1866 1.047 24 1916 1.393 30 1966 -.492 32 2016 -.532 32 1

1817 .294 4 1867 .243 24 1917 1.003 30 1967 1.140 32

1818 -.326 4 1868 -.506 24 1918 -.030 30 1968 .625 32

1819 .846 4 1869 -.675 24 1919 .578 31 1969 .630 32

1820 -1.249 4 1870 -.267 24 1920 -1.015 31 1970 -1.994 32

1821 -.603 4 1871 -.880 24 1921 -1.372 31 1971 -.163 32

1822 -.917 5 1872 .363 24 1922 -.234 31 1972 .010 32

1823 -.692 5 1873 -.924 24 1923 -1.409 31 1973 1.980 32

1824 1.086 5 1874 1.852 24 1924 -.075 31 1974 .241 32

1825 .286 6 1875 -.348 24 1925 .969 31 1975 -.006 32

1826 -1.518 9 1876 -.453 25 1926 .847 31 1976 .072 32

1827 .642 9 1877 -1.399 25 1927 .877 32 1977 -.622 32

1828 -.236 10 1878 -.092 25 1928 1.223 32 1978 -.457 32

1829 -1.051 10 1879 -.627 26 1929 1.497 32 1979 -.093 32

1830 1.232 10 1880 .113 26 1930 1.291 32 1980 -.064 32

1831 .071 11 1881 -.449 26 1931 .399 32 1981 -1.387 32

1832 .472 11 1882 .974 26 1932 -.418 32 1982 .510 32

1833 1.000 11 1883 -.825 28 1933 -.126 32 1983 1.150 32

1834 1.154 11 1884 -.604 28 1934 -2.796 32 1984 -.089 32

1835 .827 12 1885 -1.804 28 1935 -.684 32 1985 -.192 32

1836 -1.427 12 1886 .294 28 1936 -1.285 32 1986 1.334 32

1837 .405 13 1887 -.330 28 1937 .228 32 1987 1.430 32

1838 .497 15 1888 -.807 28 1938 -.542 32 1988 -1.480 32

1839 .958 16 1889 1.520 28 1939 -.369 32 1989 .556 32

1840 .161 16 1890 .657 28 1940 -.229 32 1990 .843 32

1841 .723 16 1891 .821 28 1941 -.849 32 1991 .514 32

1842 2.158 16 1892 1.437 28 1942 -1.124 32 1992 .870 32

1843 -1.584 16 1893 -.121 28 1943 .228 32 1993 -.179 32

1844 -.235 16 1894 .343 28 1944 .205 32 1994 -.282 32

1845 -.244 17 1895 -.940 28 1945 1.269 32 1995 -2.375 32

1846 -.618 17 1896 -.908 28 1946 1.709 32 1996 .325 32

1847 -.533 18 1897 .964 28 1947 1.291 32 1997 -.916 32

1798 -.553 1 1848 -.218 18 1898 -.220 28 1948 -1.646 32 1998 .755 32

1799 -.413 1 1849 -.684 18 1899 -1.231 28 1949 .152 32 1999 -.960 32

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PART 4: Master Bar Plot: BB\_TSCA\_corr1-50 11:39 Thu 18 Jan 2018 Page 4

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Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value

1800-------B 1850-------B 1900--c 1950h 2000---a

1801m 1851-----@ 1901------A 1951-------B 2001-------B

1802----------F 1852g 1902---------E 1952-----a 2002---b

1803----------J 1853---b 1903---------D 1953------@ 2003f

1804-d 1854-e 1904------A 1954-------B 2004--c

1805-------C 1855-----@ 1905----------F 1955--------C 2005---------E

1806------A 1856g 1906---------D 1956------A 2006-----@

1807-------B 1857-----@ 1907-------B 1957----------G 2007------A

1808--b 1858---b 1908--c 1958-----@ 2008----a

1809----------F 1859-d 1909-d 1959---b 2009----------F

1810---b 1860----a 1910---b 1960-d 2010----------F

1811---b 1861---------E 1911j 1961---------E 2011--c

1812-------B 1862---------E 1912g 1962--c 2012-------B

1813-------B 1863----------H 1913----a 1963------A 2013--------C

1814---------E 1864--------C 1914-----@ 1964---b 2014----a

1815----------E 1865---------E 1915----------E 1965i 2015--c

1816-e 1866---------D 1916----------F 1966---b 2016---b

1817------A 1867------A 1917---------D 1967---------E

1818----a 1868---b 1918-----@ 1968-------B

1819--------C 1869--c 1919-------B 1969-------C

1820-e 1870----a 1920-d 1970h

1821--b 1871-d 1921-e 1971----a

1822-d 1872------A 1922----a 1972-----@

1823--c 1873-d 1923f 1973----------H

1824---------D 1874----------G 1924-----@ 1974------A

1825------A 1875---a 1925--------D 1975-----@

1826f 1876---b 1926--------C 1976-----@

1827-------C 1877-f 1927--------D 1977--b

1828----a 1878-----@ 1928---------E 1978---b

1829-d 1879--c 1929----------F 1979-----@

1830---------E 1880------@ 1930---------E 1980-----@

1831-----@ 1881---b 1931-------B 1981-f

1832-------B 1882--------D 1932---b 1982-------B

1833--------D 1883--c 1933-----a 1983---------E

1834---------E 1884--b 1934k 1984-----@

1835--------C 1885g 1935--c 1985----a

1836f 1886------A 1936-e 1986---------E

1837-------B 1887----a 1937------A 1987----------F

1838-------B 1888--c 1938---b 1988f

1839--------D 1889----------F 1939---a 1989-------B

1840------A 1890-------C 1940----a 1990--------C

1841--------C 1891--------C 1941--c 1991-------B

1842----------I 1892----------F 1942-d 1992--------C

1843f 1893-----@ 1943------A 1993----a

1844----a 1894------A 1944------A 1994----a

1845----a 1895-d 1945---------E 1995i

1846--b 1896-d 1946----------G 1996------A

1847---b 1897--------D 1947---------E 1997-d

1798---b 1848----a 1898----a 1948g 1998--------C

1799---b 1849--c 1899-e 1949------A 1999-d

PART 5: CORRELATION OF SERIES BY SEGMENTS: BB\_TSCA\_corr1-50 11:39 Thu 18 Jan 2018 Page 5

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Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1800 1825 1850 1875 1900 1925 1950 1975

1849 1874 1899 1924 1949 1974 1999 2024

--- -------- --------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

1 1139A 1904 2016 .62 .67 .69 .76

2 1139B 1883 2016 .42 .60 .61 .66 .70

3 1140A 1862 2016 .66 .67 .69 .62 .58 .69

4 1140B 1835 2016 .78 .73 .66 .67 .71 .62 .70

5 1141A 1838 2016 .80 .78 .77 .70 .73 .74 .70

6 1141B 1847 2016 .71 .73 .73 .64 .73 .65 .58

7 1142A 1845 2016 .77 .85 .83 .76 .75 .75 .67

8 1142B 1853 2016 .69 .65 .74 .67 .68 .66

9 1143A 1839 2016 .72 .70 .69 .86 .88 .81 .74

10 1143B 1837 2016 .75 .71 .80 .92 .77 .51 .50

11 1144A 1826 2016 .77 .70 .69 .69 .74 .81 .76

12 1144B 1831 2016 .73 .77 .81 .78 .76 .73 .67

13 1145A 1876 2016 .43 .69 .80 .79 .80

14 1145B 1879 2016 .53 .84 .86 .79 .79

15 1146A 1883 2016 .87 .90 .85 .78 .71

16 1146B 1927 2016 .73 .72 .67

17 1401A 1838 2016 .74 .82 .84 .88 .85 .81 .82

18 1401B 1816 2016 .76 .84 .78 .72 .76 .78 .85 .73

19 1402A 1826 2016 .77 .73 .72 .80 .78 .80 .78

20 1402B 1798 2016 .60 .75 .71 .69 .68 .74 .82 .70

21 1403A 1919 2016 .83 .82 .81 .77

22 1403B 1905 2016 .79 .79 .83 .74

23 1404A 1852 2016 .73 .76 .79 .71 .64 .62

24 1404B 1825 2016 .42 .70 .70 .84 .81 .78 .86

25 1405A 1828 2016 .73 .72 .75 .88 .86 .83 .77

26 1405B 1826 2016 .80 .82 .84 .78 .78 .85 .82

27 1406A 1865 2016 .77 .78 .87 .79 .80 .82

28 1406B 1861 2016 .76 .80 .73 .77 .81 .72

29 1407A 1822 2016 .69 .69 .71 .74 .88 .84 .81 .75

30 1407B 1856 2016 .82 .80 .88 .87 .82 .80

31 1408A 1811 2016 .75 .86 .79 .79 .87 .81 .81 .82

32 1408B 1811 2016 .81 .82 .78 .84 .89 .85 .79 .80

Av segment correlation .72 .75 .75 .73 .78 .77 .76 .73

PART 6: POTENTIAL PROBLEMS: BB\_TSCA\_corr1-50 11:39 Thu 18 Jan 2018 Page 5

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

[A] Correlations with master dating series of flagged 50-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

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[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

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1139A 1904 to 2016 113 years Series 1

[B] Entire series, effect on correlation ( .660) is:

Lower 1911< -.026 1928< -.012 1945< -.009 1957< -.009 1959< -.008 1920> -.007 Higher 1988 .019 1934 .014

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

1911 -7.2 SD

1139A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 172 193 141 159 139 124

1910 133 26 100 178 183 146 150 144 120 162

1920 142 99 128 100 148 164 157 117 83 123

1930 115 83 68 94 41 68 60 85 54 49

1940 38 32 43 44 43 41 98 123 41 62

1950 48 80 59 83 113 96 91 100 132 37

1960 120 287 163 246 147 86 194 202 169 180

1970 110 130 252 265 217 173 234 195 207 170

1980 169 91 157 194 166 142 177 130 59 89

1990 101 87 98 62 66 51 81 69 102 68

2000 78 91 77 63 84 118 110 111 122 164

2010 164 107 110 103 68 75 95

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

1139B 1883 to 2016 134 years Series 2

[B] Entire series, effect on correlation ( .575) is:

Lower 1928< -.026 1883> -.024 1889< -.012 1967< -.011 1885> -.010 1959< -.007 Higher 1934 .019 1965 .015

[E] Outliers 4 3.0 SD above or -4.5 SD below mean for year

1883 +3.7 SD; 1885 +3.2 SD; 1911 -7.0 SD; 1928 -4.6 SD

1139B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1883 52 36 34 37 28 23 24

1890 38 36 33 11 22 19 36 79 80 54

1900 87 87 127 92 62 95 107 102 92 92

1910 96 14 55 86 91 112 103 75 75 112

1920 92 69 87 54 86 106 87 78 31 78

1930 87 42 41 66 20 51 40 43 30 34

1940 24 25 43 46 40 59 112 124 51 71

1950 41 72 61 76 80 66 37 66 88 24

1960 56 126 71 102 82 39 105 86 94 123

1970 75 103 200 255 231 177 237 178 199 224

1980 199 115 221 208 208 181 216 165 106 120

1990 125 104 142 84 100 70 91 79 114 77

2000 88 100 87 82 74 97 70 99 98 114

2010 107 53 67 78 54 57 64

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1140A 1862 to 2016 155 years Series 3

[B] Entire series, effect on correlation ( .631) is:

Lower 1959< -.025 1995> -.013 1863< -.009 1862< -.008 1891< -.007 1931< -.007 Higher 1970 .020 1934 .018

1140A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1862 149 158 163 241 225 161 125 148

1870 164 119 133 110 188 114 110 88 104 73

1880 82 80 117 69 71 55 60 44 49 123

1890 105 61 63 71 104 54 78 104 115 93

1900 116 94 131 171 133 265 157 145 116 116

1910 140 78 101 151 162 211 181 135 129 212

1920 129 149 116 100 115 149 200 171 121 107

1930 82 41 48 64 25 40 62 65 55 45

1940 37 42 46 51 61 73 136 107 61 86

1950 53 70 71 84 60 57 48 77 86 40

1960 76 111 100 89 98 59 101 147 151 142

1970 62 176 184 203 158 149 132 128 145 130

1980 116 73 111 164 87 114 119 129 77 89

1990 105 127 105 114 85 84 93 92 90 74

2000 69 89 53 34 47 91 80 101 102 163

2010 124 78 104 125 66 46 76

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1140B 1835 to 2016 182 years Series 4

[B] Entire series, effect on correlation ( .694) is:

Lower 1911< -.020 1994< -.013 1964> -.010 1999> -.006 1945< -.004 1888> -.004 Higher 1843 .010 1934 .008

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1911 -8.1 SD; 1964 +3.7 SD

1140B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1835 70 33 58 48 68

1840 87 89 109 32 51 45 34 72 59 58

1850 80 97 47 80 32 50 48 68 128 81

1860 139 169 141 139 123 195 173 145 113 117

1870 114 99 107 100 154 114 101 96 139 100

1880 124 98 148 113 106 95 165 156 170 178

1890 174 211 194 156 154 168 152 195 176 136

1900 169 174 230 196 125 134 138 117 98 107

1910 97 33 67 99 107 103 124 115 74 105

1920 99 88 125 87 101 126 139 170 172 129

1930 94 66 62 70 30 51 44 45 39 42

1940 32 34 39 45 52 42 53 66 36 64

1950 37 52 41 54 52 83 76 100 79 49

1960 90 120 118 152 197 96 134 172 148 133

1970 100 131 122 184 126 112 128 176 216 196

1980 261 150 226 365 210 189 237 227 133 155

1990 188 189 161 154 82 83 124 111 123 118

2000 86 99 80 60 67 108 79 78 74 136

2010 144 79 126 125 90 70 88

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1141A 1838 to 2016 179 years Series 5

[B] Entire series, effect on correlation ( .733) is:

Lower 1948> -.021 1988< -.007 1934> -.006 1999> -.004 1993> -.004 1995> -.004 Higher 1965 .012 1843 .008

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

1948 +3.3 SD

1141A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1838 178 210

1840 159 142 180 87 164 150 128 146 151 155

1850 205 163 139 148 136 180 167 255 212 176

1860 203 281 319 420 302 249 281 257 245 175

1870 166 190 230 158 283 175 190 129 159 143

1880 167 143 161 146 128 81 117 128 155 228

1890 192 196 160 113 129 118 98 179 106 108

1900 103 123 171 203 189 190 171 98 80 86

1910 88 64 46 66 81 122 159 134 91 128

1920 59 50 82 67 104 103 88 82 103 99

1930 76 63 55 50 41 37 45 50 45 43

1940 37 31 23 32 45 57 73 58 48 48

1950 15 33 35 47 47 51 38 45 34 28

1960 18 31 27 30 39 17 25 37 44 57

1970 35 52 41 80 59 61 56 55 49 54

1980 57 52 57 66 57 59 78 86 43 56

1990 88 79 74 80 70 61 71 68 70 68

2000 59 59 57 53 56 71 59 86 66 87

2010 110 68 67 70 61 52 55

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1141B 1847 to 2016 170 years Series 6

[B] Entire series, effect on correlation ( .673) is:

Lower 1948> -.022 1990< -.011 1999> -.009 1976< -.007 1997> -.006 1977> -.005 Higher 1965 .016 1950 .011

1141B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1847 147 156 127

1850 185 196 144 177 133 182 172 241 181 169

1860 176 267 369 429 248 201 241 207 178 145

1870 183 159 232 175 251 162 161 107 194 148

1880 168 180 196 132 141 86 118 132 117 161

1890 134 113 133 134 121 89 88 149 107 93

1900 76 91 114 116 98 156 150 150 91 98

1910 83 54 46 66 75 87 83 80 82 87

1920 34 40 61 49 82 99 73 90 111 136

1930 135 106 51 66 44 68 59 53 59 48

1940 45 42 26 46 49 79 77 49 52 49

1950 21 40 43 59 62 73 59 85 61 50

1960 38 64 43 42 58 27 40 49 50 53

1970 37 47 48 81 55 63 43 65 53 63

1980 55 58 85 93 51 63 66 78 47 48

1990 41 56 53 57 42 40 47 53 49 53

2000 42 52 48 41 44 59 43 65 50 71

2010 77 35 57 61 60 49 49

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1142A 1845 to 2016 172 years Series 7

[B] Entire series, effect on correlation ( .731) is:

Lower 1981> -.011 2011< -.011 1990< -.007 1847> -.006 1930< -.006 1947< -.005 Higher 1934 .017 1995 .011

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1848 +3.1 SD; 1981 +3.3 SD; 1998 +3.1 SD

1142A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1845 128 117 161 192 154

1850 157 124 102 126 95 146 45 141 156 143

1860 147 338 468 479 302 340 307 203 132 99

1870 145 117 133 103 172 88 131 83 95 108

1880 155 115 144 76 77 72 102 94 72 164

1890 163 229 210 119 114 73 95 157 108 89

1900 83 116 168 154 92 143 152 145 102 99

1910 85 55 45 65 84 149 154 137 97 106

1920 83 66 58 37 62 77 63 91 104 77

1930 57 68 53 50 28 58 38 58 59 60

1940 58 43 44 49 46 82 74 48 37 52

1950 33 40 33 45 43 44 42 64 50 36

1960 36 55 38 53 40 32 50 69 43 56

1970 30 54 35 46 36 42 39 36 34 51

1980 53 56 65 63 41 45 63 59 38 55

1990 46 50 78 57 60 34 61 58 115 70

2000 90 73 63 57 58 68 70 66 82 79

2010 89 53 59 88 73 78 68

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1142B 1853 to 2016 164 years Series 8

[B] Entire series, effect on correlation ( .672) is:

Lower 1883< -.027 1973< -.016 1988> -.012 2011> -.007 1934> -.007 1904< -.005 Higher 1970 .017 1995 .012

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

1883 -4.7 SD

1142B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1853 85 59 81 56 83 93 71

1860 94 132 210 284 194 189 194 138 126 112

1870 163 109 112 115 189 92 126 78 113 108

1880 120 99 115 37 85 59 77 59 84 131

1890 121 137 118 64 93 53 66 96 89 88

1900 79 96 155 155 76 116 115 115 90 67

1910 67 57 60 87 105 141 123 106 74 104

1920 92 70 57 41 67 89 83 113 110 132

1930 114 74 57 65 48 61 41 64 43 41

1940 37 37 36 42 45 75 85 50 34 55

1950 35 36 29 44 42 41 47 78 59 46

1960 39 59 48 51 38 33 56 84 47 47

1970 24 52 47 40 43 46 41 39 40 40

1980 41 39 58 54 40 48 65 65 61 76

1990 72 79 107 74 78 46 78 57 105 66

2000 74 73 83 75 62 98 102 109 135 144

2010 140 126 132 138 120 110 102

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1143A 1839 to 2016 178 years Series 9

[B] Entire series, effect on correlation ( .772) is:

Lower 2008< -.015 1883> -.009 1988> -.008 1873< -.006 1897< -.005 1998< -.004 Higher 1934 .009 1970 .008

1143A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1839 115

1840 88 93 103 31 36 49 45 59 66 43

1850 91 112 73 132 110 127 103 138 153 136

1860 203 421 495 520 282 342 400 344 284 272

1870 247 233 330 169 341 209 264 214 292 222

1880 220 231 270 264 202 189 237 226 201 211

1890 189 234 403 249 173 112 108 127 111 87

1900 129 115 156 236 227 345 303 206 141 160

1910 159 109 113 161 191 285 233 217 145 126

1920 64 63 92 74 105 127 110 94 121 163

1930 140 95 90 89 53 82 64 73 59 59

1940 59 47 46 65 56 68 70 64 41 52

1950 34 55 49 51 50 59 49 66 52 41

1960 42 58 42 43 52 28 44 60 53 55

1970 40 63 61 88 71 68 69 63 57 80

1980 80 64 90 91 81 71 88 90 82 105

1990 104 97 106 91 93 66 90 78 76 77

2000 75 79 69 68 70 102 84 83 55 90

2010 103 71 92 78 80 70 67

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

1143B 1837 to 2016 180 years Series 10

[B] Entire series, effect on correlation ( .688) is:

Lower 1965< -.021 1988> -.016 1986< -.015 1970> -.010 1977> -.007 1984> -.007 Higher 1948 .010 1995 .009

[C] Year-to-year changes diverging by over 4.0 std deviations:

1964 1965 -4.4 SD

[D] 1 Absent rings: Year Master N series Absent

1965 -2.364 32 1

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

1965 -7.6 SD

1143B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1837 45 40 52

1840 72 58 81 17 29 35 27 73 59 74

1850 72 62 60 84 55 68 64 120 157 163

1860 225 335 517 515 340 366 430 410 357 289

1870 296 268 352 180 310 160 176 166 260 239

1880 273 239 275 209 211 154 265 277 251 337

1890 227 201 294 212 246 179 189 418 191 214

1900 204 267 305 310 260 325 316 282 190 187

1910 160 109 100 135 141 185 162 157 105 125

1920 75 65 75 51 91 109 104 105 141 127

1930 128 87 83 77 48 68 54 80 60 60

1940 56 54 47 73 58 61 69 63 36 57

1950 30 53 44 49 49 61 47 59 41 31

1960 38 39 38 45 46 0 22 24 26 38

1970 36 42 42 70 66 59 68 83 73 74

1980 74 62 80 95 111 94 90 118 113 125

1990 124 131 135 125 136 88 105 103 141 104

2000 107 98 93 85 76 124 117 105 66 100

2010 89 57 88 79 62 45 48

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1144A 1826 to 2016 191 years Series 11

[B] Entire series, effect on correlation ( .734) is:

Lower 1948> -.031 1883> -.016 1835< -.014 2003> -.007 1834< -.003 1918> -.003 Higher 1843 .012 1995 .009

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1883 +3.6 SD; 1948 +4.3 SD

1144A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1826 57 101 90 83

1830 101 78 85 114 88 61 58 94 110 109

1840 106 114 151 64 73 99 87 99 116 115

1850 136 123 106 158 118 145 100 116 110 117

1860 180 295 334 394 242 269 217 220 220 239

1870 196 155 209 170 226 132 149 97 126 131

1880 147 135 141 196 125 106 126 119 140 236

1890 176 159 195 146 130 80 98 126 105 70

1900 89 106 164 144 121 171 175 85 60 60

1910 71 56 53 54 80 164 136 119 130 99

1920 79 72 93 63 83 115 101 89 90 99

1930 87 77 57 56 42 52 48 51 50 44

1940 51 38 40 58 62 64 83 79 74 54

1950 33 55 50 52 63 62 59 82 54 62

1960 50 82 56 70 64 31 49 60 55 60

1970 43 63 68 76 55 64 57 61 58 74

1980 66 59 74 98 76 72 80 101 79 97

1990 89 83 104 100 111 66 96 90 125 85

2000 101 144 90 105 101 128 97 96 93 122

2010 130 99 120 143 94 95 100

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1144B 1831 to 2016 186 years Series 12

[B] Entire series, effect on correlation ( .741) is:

Lower 1948> -.019 1970> -.012 1984> -.009 1879> -.005 1835< -.004 1894< -.004 Higher 1965 .008 1950 .007

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

1948 +3.1 SD

1144B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1831 128 93 134 130 90 70 86 99 106

1840 76 82 135 58 94 106 100 131 129 122

1850 131 128 127 159 130 191 160 176 170 202

1860 255 449 426 414 245 290 275 209 256 220

1870 198 154 239 156 300 162 169 131 163 199

1880 191 176 193 115 112 93 131 148 141 245

1890 139 152 150 100 77 70 66 144 94 75

1900 94 146 184 154 138 210 182 160 119 114

1910 116 77 60 76 76 133 134 127 89 113

1920 74 71 107 72 107 161 142 124 142 153

1930 142 110 79 78 52 75 69 79 59 78

1940 64 50 43 62 62 68 86 73 61 49

1950 31 51 53 53 58 58 58 86 47 44

1960 35 49 41 52 58 33 59 87 67 69

1970 58 56 51 82 62 63 56 70 66 68

1980 65 81 90 107 148 119 121 155 106 188

1990 180 150 174 125 129 75 176 126 215 98

2000 137 126 92 80 91 136 112 142 97 160

2010 165 111 163 185 126 124 101

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1145A 1876 to 2016 141 years Series 13

[B] Entire series, effect on correlation ( .666) is:

Lower 1887< -.047 1877> -.017 1907< -.017 1965> -.011 1889< -.007 1896> -.006 Higher 1970 .019 1948 .018

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1877 +3.6 SD; 1878 +3.2 SD; 1887 -6.0 SD

1145A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1876 202 292 362 207

1880 233 180 229 163 124 103 160 23 67 140

1890 182 226 300 245 402 216 315 401 273 219

1900 306 423 342 302 203 268 234 119 160 172

1910 139 97 104 125 125 171 152 175 123 94

1920 67 65 87 83 132 164 153 159 180 145

1930 104 76 90 99 59 107 82 147 123 102

1940 135 98 134 193 197 205 197 164 72 105

1950 79 146 132 133 156 185 184 211 138 121

1960 122 160 86 106 86 92 97 146 131 109

1970 62 102 114 170 133 117 131 157 154 144

1980 159 134 176 191 187 144 205 199 124 130

1990 152 141 129 98 86 69 98 88 148 89

2000 71 98 99 56 80 110 70 65 66 91

2010 122 82 94 110 83 75 103

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1145B 1879 to 2016 138 years Series 14

[B] Entire series, effect on correlation ( .727) is:

Lower 1887< -.023 1889< -.014 1888< -.011 1965> -.008 1909> -.008 1895> -.008 Higher 1934 .018 1948 .017

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

1888 -5.0 SD

1145B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1879 211

1880 218 176 250 160 165 148 254 49 13 104

1890 163 253 280 233 257 262 300 376 219 166

1900 174 221 238 251 129 194 169 120 145 187

1910 159 57 67 131 140 196 180 144 90 73

1920 37 51 56 38 66 96 104 102 99 90

1930 82 66 70 54 28 67 53 86 63 55

1940 62 78 70 88 84 130 130 99 43 86

1950 59 101 85 85 89 94 88 143 78 78

1960 75 86 58 73 65 65 72 111 88 90

1970 58 87 70 109 91 88 97 81 98 98

1980 96 64 101 132 95 105 161 140 93 110

1990 105 88 114 79 79 64 79 69 102 69

2000 74 84 89 57 67 84 57 62 58 69

2010 126 65 79 88 62 62 70

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1146A 1883 to 2016 134 years Series 15

[B] Entire series, effect on correlation ( .796) is:

Lower 2006> -.014 1999< -.009 1981> -.006 1940> -.005 1896> -.004 2013< -.004 Higher 1948 .011 1995 .010

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1897 +3.2 SD; 2006 +3.5 SD

1146A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1883 172 213 176 341 311 274 385

1890 306 325 358 309 297 298 348 621 332 189

1900 198 318 400 327 276 382 316 242 184 140

1910 152 100 121 163 192 238 248 182 134 168

1920 116 85 165 102 156 184 214 186 219 185

1930 169 116 97 102 50 72 71 82 51 70

1940 130 75 70 109 106 127 135 148 52 94

1950 66 117 93 102 80 112 108 110 75 90

1960 74 123 78 99 74 64 90 156 173 133

1970 85 103 171 316 153 119 151 131 121 123

1980 197 168 168 178 182 144 250 235 139 200

1990 305 185 201 142 147 96 197 131 195 107

2000 191 174 188 144 181 238 271 178 196 208

2010 208 154 153 152 136 153 146

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1146B 1927 to 2016 90 years Series 16

[B] Entire series, effect on correlation ( .691) is:

Lower 2006> -.023 1979< -.011 1965> -.008 1987< -.007 1934> -.006 2007< -.006 Higher 1995 .016 1973 .012

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

2006 +3.7 SD

1146B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 140 209 204

1930 155 129 76 60 44 43 45 72 51 71

1940 79 60 61 92 82 126 125 138 35 81

1950 72 113 97 104 139 121 134 163 107 126

1960 112 144 101 159 85 83 118 206 211 167

1970 91 129 199 325 220 157 210 132 138 63

1980 67 50 83 85 100 116 161 107 68 89

1990 106 91 94 69 77 45 100 60 94 53

2000 106 117 130 78 142 231 320 165 201 246

2010 192 144 145 180 132 123 96

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1401A 1838 to 2016 179 years Series 17

[B] Entire series, effect on correlation ( .812) is:

Lower 1843> -.013 1847< -.010 1995> -.007 1888> -.005 2016> -.004 1886< -.003 Higher 1934 .009 1948 .006

1401A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1838 74 87

1840 66 71 94 54 51 53 33 25 54 45

1850 63 45 26 55 48 68 56 81 87 86

1860 93 140 98 140 118 123 106 95 82 80

1870 90 77 90 63 117 62 59 59 86 59

1880 65 50 73 52 66 31 52 62 94 139

1890 116 125 144 92 111 61 56 89 84 53

1900 65 77 113 112 84 120 95 111 63 49

1910 71 57 51 79 73 98 110 90 75 90

1920 58 50 56 42 56 72 84 75 80 79

1930 71 58 59 68 29 54 38 56 47 41

1940 34 36 34 40 36 65 54 48 18 47

1950 26 38 43 41 41 44 53 47 32 39

1960 35 66 40 57 51 42 57 76 76 75

1970 51 66 93 159 85 82 92 69 79 75

1980 70 58 81 84 61 79 106 107 61 87

1990 99 99 84 84 77 65 119 62 71 50

2000 64 86 60 44 66 109 66 83 57 113

2010 95 50 77 80 76 71 91

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1401B 1816 to 2016 201 years Series 18

[B] Entire series, effect on correlation ( .745) is:

Lower 1948< -.017 2010< -.013 1818> -.012 1883> -.008 1903< -.006 2014> -.005 Higher 1995 .006 1973 .005

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1818 +3.4 SD; 1948 -8.2 SD

1401B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1816 23 66 99 88

1820 59 65 77 71 95 68 40 112 58 58

1830 72 71 78 103 109 98 55 97 102 100

1840 79 101 134 53 71 74 61 33 47 48

1850 78 56 35 52 58 96 58 98 113 96

1860 108 210 251 265 181 217 196 147 118 134

1870 131 123 200 154 216 138 138 132 118 135

1880 150 122 176 187 108 94 124 219 162 234

1890 204 244 309 177 171 118 101 161 149 104

1900 124 171 206 125 129 200 153 139 94 67

1910 108 82 72 143 103 135 151 128 98 102

1920 80 75 99 68 89 135 130 110 135 111

1930 82 70 66 59 35 38 36 60 47 48

1940 55 49 37 40 42 74 59 59 5 48

1950 26 45 40 51 53 50 67 85 57 62

1960 51 89 59 63 58 43 66 90 82 64

1970 47 55 85 148 106 97 109 92 102 90

1980 82 65 94 106 82 89 117 113 77 103

1990 143 122 107 87 95 67 97 77 92 76

2000 92 106 79 82 94 140 77 89 72 106

2010 70 58 74 76 91 71 81

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1402A 1826 to 2016 191 years Series 19

[B] Entire series, effect on correlation ( .717) is:

Lower 2011< -.050 1877> -.007 1843> -.006 1862< -.006 1970> -.005 1875> -.004 Higher 1934 .014 1988 .007

[D] 1 Absent rings: Year Master N series Absent

2011 -.749 32 2

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

2011-10.1 SD

1402A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1826 120 148 133 114

1830 173 130 148 172 148 169 82 125 116 120

1840 106 116 162 96 115 106 97 99 90 79

1850 142 102 75 96 98 130 58 144 134 120

1860 145 176 118 228 154 187 198 113 153 126

1870 126 88 180 139 276 177 144 176 148 170

1880 158 120 166 135 125 102 141 169 131 243

1890 184 201 292 200 225 161 148 213 147 140

1900 105 151 183 183 182 215 218 189 103 101

1910 124 93 81 110 95 152 130 118 95 113

1920 92 83 130 82 96 112 91 93 119 118

1930 113 94 72 76 41 63 61 71 62 62

1940 56 43 49 68 55 62 64 62 44 44

1950 39 73 54 48 76 69 68 89 58 58

1960 50 74 38 42 32 35 41 71 66 52

1970 45 60 65 82 58 54 55 41 47 49

1980 50 43 53 56 56 56 63 71 40 71

1990 54 55 56 42 47 35 54 37 46 36

2000 33 47 37 27 35 48 34 37 27 26

2010 36 0 17 19 18 14 8

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1402B 1798 to 2016 219 years Series 20

[\*] Early part of series cannot be checked from 1798 to 1810 -- not matched by another series

[B] Entire series, effect on correlation ( .698) is:

Lower 1818> -.009 1946< -.007 1843> -.007 1927< -.007 1875> -.006 1824< -.005 Higher 1934 .015 1965 .009

[D] 3 Absent rings: Year Master N series Absent

2011 -.749 32 2

2015 -.673 32 1

2016 -.532 32 1

>> WARNING: Last ring in series is ABSENT

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1818 +3.2 SD; 1943 +3.9 SD

1402B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1798 197 204

1800 241 133 282 340 192 245 231 233 204 264

1810 203 203 235 223 201 208 179 200 217 223

1820 138 145 151 141 152 146 131 185 159 111

1830 199 144 154 176 184 193 123 192 198 170

1840 154 153 189 132 122 133 142 139 122 97

1850 163 137 109 101 122 183 127 198 134 127

1860 146 230 168 276 209 213 197 152 138 133

1870 146 109 158 121 221 169 133 140 122 110

1880 122 115 138 138 113 102 159 161 107 189

1890 145 143 170 115 165 140 113 136 96 87

1900 82 125 151 136 150 159 124 108 62 51

1910 103 75 65 96 89 137 120 118 106 98

1920 63 57 91 63 69 87 66 55 75 83

1930 89 68 60 58 38 58 43 56 56 58

1940 66 53 61 87 61 57 51 59 49 46

1950 39 74 54 50 62 62 64 87 51 54

1960 56 95 48 57 41 33 54 76 62 59

1970 43 57 77 97 76 60 85 56 76 74

1980 65 48 77 69 81 62 82 112 62 93

1990 88 69 68 61 69 47 83 50 52 46

2000 34 57 53 41 53 78 53 56 23 37

2010 30 0 29 25 14 0 0

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1403A 1919 to 2016 98 years Series 21

[B] Entire series, effect on correlation ( .782) is:

Lower 2003> -.016 1948> -.014 1996< -.012 1992< -.009 1981> -.009 1977> -.008 Higher 1965 .016 1995 .012

1403A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 116

1920 83 87 132 96 119 176 163 185 163 154

1930 150 159 111 112 71 77 68 74 66 77

1940 68 60 46 49 54 70 84 84 58 66

1950 44 85 72 55 68 82 63 86 58 59

1960 50 58 48 55 53 36 53 76 81 98

1970 52 72 75 109 93 81 85 94 84 89

1980 80 86 105 122 89 90 91 100 74 90

1990 109 96 79 76 86 63 65 61 81 79

2000 81 95 76 91 99 122 78 85 90 144

2010 169 86 102 98 92 79 85

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1403B 1905 to 2016 112 years Series 22

[B] Entire series, effect on correlation ( .769) is:

Lower 2015> -.012 1937< -.010 2010< -.008 1911> -.007 2003> -.007 1965> -.006 Higher 1970 .013 1988 .010

1403B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 350 246 249 152 144

1910 172 152 119 185 177 262 273 267 192 202

1920 132 129 158 114 140 176 172 187 191 168

1930 176 178 129 129 90 92 98 84 87 97

1940 108 88 79 92 106 91 89 99 54 68

1950 50 104 92 81 109 126 109 151 106 109

1960 95 116 93 130 108 92 114 187 223 224

1970 101 110 119 178 132 133 139 130 125 130

1980 167 139 155 194 150 123 149 185 118 159

1990 190 152 192 147 127 101 112 100 123 115

2000 146 169 145 149 157 236 153 157 199 320

2010 223 161 162 198 172 263 246

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1404A 1852 to 2016 165 years Series 23

[B] Entire series, effect on correlation ( .683) is:

Lower 1968< -.017 1976< -.013 1939< -.009 2004< -.007 1852> -.007 1977> -.007 Higher 1970 .015 1995 .012

1404A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1852 87 92 79 119 111 152 140 117

1860 164 284 324 448 263 304 285 252 194 180

1870 179 185 162 135 192 209 146 117 149 135

1880 160 162 234 223 177 138 240 217 232 380

1890 301 322 356 254 317 261 250 332 229 169

1900 197 228 224 255 208 221 250 254 171 117

1910 153 131 134 233 185 276 267 286 185 238

1920 142 141 158 134 159 218 208 203 204 208

1930 231 175 126 130 90 104 94 118 92 65

1940 74 81 72 75 84 104 103 90 63 83

1950 59 80 87 67 62 96 81 117 106 88

1960 58 99 82 84 98 73 91 165 87 109

1970 68 79 93 140 124 123 84 131 112 109

1980 124 107 156 183 116 108 138 126 101 95

1990 104 102 101 84 84 65 73 60 72 65

2000 76 82 76 58 52 96 65 87 87 80

2010 92 82 105 96 84 69 87

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1404B 1825 to 2016 192 years Series 24

[B] Entire series, effect on correlation ( .677) is:

Lower 1838< -.036 1883< -.027 1827< -.020 1833< -.011 1836> -.008 1831> -.006 Higher 1970 .010 1911 .010

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1827 -5.1 SD; 1838 -6.0 SD; 1883 -6.2 SD

1404B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1825 90 72 57 79 86

1830 92 125 133 82 88 105 97 99 45 99

1840 118 122 139 72 97 73 87 65 73 79

1850 90 96 56 120 91 139 108 109 114 96

1860 127 244 174 174 161 170 170 158 94 93

1870 116 113 129 120 189 130 115 101 121 95

1880 112 133 150 48 102 101 198 150 146 254

1890 198 210 296 237 249 167 159 264 178 114

1900 128 138 176 234 158 154 218 173 135 124

1910 134 49 74 142 125 210 196 169 79 118

1920 60 83 79 76 129 185 164 235 207 227

1930 236 184 110 139 50 81 56 83 66 59

1940 62 63 47 64 65 76 92 67 42 63

1950 35 62 50 52 48 45 40 73 51 64

1960 41 80 70 77 106 64 84 148 169 195

1970 68 99 95 143 98 112 97 94 102 118

1980 151 121 183 224 171 170 234 184 118 150

1990 192 163 159 131 120 101 112 86 125 91

2000 109 115 98 75 102 171 118 122 145 190

2010 194 84 137 168 120 98 92

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1405A 1828 to 2016 189 years Series 25

[B] Entire series, effect on correlation ( .783) is:

Lower 1856< -.021 2013< -.006 1883< -.005 1875> -.005 1846> -.005 1833< -.004 Higher 1934 .012 1948 .009

1405A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1828 85 73

1830 120 102 121 95 128 122 77 103 116 106

1840 85 108 122 61 65 88 101 75 85 87

1850 94 98 41 60 69 113 20 108 103 70

1860 85 166 172 201 140 180 196 199 168 147

1870 138 130 138 125 255 188 150 123 110 132

1880 130 131 178 74 150 126 174 153 135 276

1890 216 234 233 171 180 118 100 152 136 120

1900 105 158 185 182 205 208 227 177 95 84

1910 115 88 79 140 129 218 227 200 117 157

1920 97 82 101 95 101 130 127 112 131 119

1930 120 101 71 73 31 53 46 74 67 53

1940 74 60 55 78 67 69 79 82 33 61

1950 42 70 64 64 61 87 79 76 53 49

1960 61 93 53 72 48 43 51 85 80 82

1970 53 66 60 108 98 85 100 71 84 94

1980 99 84 110 103 71 101 147 137 78 108

1990 115 106 102 83 72 54 89 66 66 54

2000 57 71 55 53 48 71 48 61 42 62

2010 76 46 64 42 52 34 55

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1405B 1826 to 2016 191 years Series 26

[B] Entire series, effect on correlation ( .796) is:

Lower 1934< -.012 1854> -.006 1947< -.005 2013< -.005 1943< -.003 1853< -.003 Higher 1995 .006 1852 .004

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

1934 -7.2 SD

1405B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1826 54 80 83 71

1830 115 82 88 85 117 104 74 86 111 88

1840 69 76 101 51 56 47 50 42 51 48

1850 58 56 17 25 61 80 13 87 61 57

1860 62 100 132 344 189 235 161 120 106 96

1870 116 101 118 97 182 110 99 98 116 103

1880 135 92 167 116 150 103 145 129 113 211

1890 172 175 233 143 167 119 106 128 135 94

1900 103 126 156 155 153 200 176 143 90 83

1910 105 78 77 112 107 145 166 187 135 109

1920 71 63 84 72 87 86 83 88 88 88

1930 87 68 60 61 27 53 41 61 55 56

1940 57 51 36 42 47 59 64 48 41 52

1950 42 52 52 53 63 67 58 81 58 65

1960 57 90 54 68 47 44 57 76 63 71

1970 47 69 55 97 59 63 90 65 77 85

1980 90 76 102 102 88 95 120 125 74 96

1990 121 93 102 93 65 44 82 67 72 52

2000 52 72 57 51 61 98 67 64 51 68

2010 74 54 74 53 53 47 60

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1406A 1865 to 2016 152 years Series 27

[B] Entire series, effect on correlation ( .791) is:

Lower 1965< -.010 1948> -.007 1880< -.007 1954< -.006 2000< -.005 1977< -.005 Higher 1988 .007 1874 .006

1406A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1865 123 117 112 104 95

1870 112 109 145 115 200 111 112 63 120 97

1880 75 66 111 48 75 58 97 124 114 226

1890 175 152 198 174 173 128 95 146 115 69

1900 104 120 160 139 144 151 166 120 86 70

1910 69 48 48 71 84 109 133 132 111 127

1920 71 62 90 55 76 89 91 76 86 97

1930 118 72 53 35 19 32 24 38 24 36

1940 31 27 24 33 33 41 48 45 31 41

1950 25 37 31 36 27 36 37 45 40 42

1960 31 54 28 48 35 18 29 39 37 38

1970 27 40 37 55 40 41 34 30 43 46

1980 46 42 54 58 44 40 57 70 42 77

1990 59 67 72 57 62 37 68 51 67 48

2000 42 50 60 36 57 82 72 68 63 99

2010 90 65 59 76 56 58 39

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1406B 1861 to 2016 156 years Series 28

[B] Entire series, effect on correlation ( .735) is:

Lower 1948> -.029 1999< -.009 1984> -.008 1873> -.008 1861< -.007 1974< -.007 Higher 1965 .013 1950 .008

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

1948 +3.5 SD

1406B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1861 177 197 242 200 224 186 138 98 90

1870 80 98 165 166 233 167 122 79 112 108

1880 127 109 191 102 117 109 193 91 88 219

1890 184 222 296 217 247 142 138 174 137 73

1900 99 108 172 166 139 195 160 116 75 61

1910 64 45 54 61 77 104 130 113 137 130

1920 85 63 122 74 95 130 161 134 155 151

1930 160 120 95 82 45 59 46 55 32 56

1940 51 38 33 47 59 76 86 74 70 57

1950 33 75 65 55 54 78 70 88 59 70

1960 50 83 48 72 57 39 54 78 80 85

1970 57 79 69 109 60 76 72 61 69 77

1980 65 60 84 87 108 82 113 108 58 106

1990 94 92 112 90 94 59 110 77 106 36

2000 63 75 69 60 84 135 105 73 100 137

2010 97 84 65 81 61 70 59

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1407A 1822 to 2016 195 years Series 29

[B] Entire series, effect on correlation ( .739) is:

Lower 1847< -.011 1843> -.010 1888< -.008 2016< -.008 1883> -.007 1981> -.007 Higher 1970 .010 1934 .006

1407A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1822 65 63 131 95 76 94 80 92

1830 123 91 87 123 119 107 74 87 106 97

1840 76 102 124 72 84 54 56 34 71 80

1850 67 76 80 103 92 142 87 156 119 93

1860 182 255 312 498 369 421 347 248 206 222

1870 236 221 200 164 294 182 180 132 193 213

1880 199 184 288 237 188 164 255 176 90 280

1890 188 194 279 126 166 118 86 177 155 140

1900 150 242 250 231 175 263 227 194 119 97

1910 102 87 71 117 105 177 160 127 96 99

1920 66 58 72 66 92 144 148 154 142 225

1930 220 181 104 117 50 71 61 90 77 75

1940 83 80 76 92 84 111 95 105 63 65

1950 54 75 67 69 92 86 66 98 59 76

1960 66 92 59 82 61 60 80 90 94 86

1970 52 76 80 110 75 72 83 65 78 87

1980 92 92 102 98 92 86 137 110 61 98

1990 89 77 85 72 82 62 89 68 109 65

2000 70 94 71 51 86 85 78 55 61 91

2010 81 68 72 81 84 88 52

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1407B 1856 to 2016 161 years Series 30

[B] Entire series, effect on correlation ( .830) is:

Lower 2005< -.006 1985> -.006 1966< -.005 1950> -.005 1893< -.004 2007< -.003 Higher 1970 .007 1948 .006

1407B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1856 63 106 138 120

1860 220 314 311 599 390 462 366 270 206 205

1870 299 239 301 221 355 267 188 184 231 217

1880 220 249 318 180 171 147 268 249 161 335

1890 231 216 259 154 237 182 172 323 192 197

1900 203 330 308 288 224 256 264 178 143 112

1910 155 130 140 201 202 411 336 247 178 234

1920 162 145 196 146 202 274 245 250 260 282

1930 207 202 158 140 74 85 65 95 82 93

1940 95 70 86 103 101 137 134 115 56 88

1950 79 123 103 100 110 121 106 143 88 102

1960 100 154 91 107 89 73 74 109 102 92

1970 72 94 113 140 99 121 127 100 90 115

1980 120 103 120 141 102 143 143 134 88 146

1990 130 103 124 92 83 64 113 95 120 90

2000 105 121 79 57 67 76 76 63 65 98

2010 104 75 90 101 76 71 64

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1408A 1811 to 2016 206 years Series 31

[B] Entire series, effect on correlation ( .799) is:

Lower 1818< -.018 1894< -.008 1826> -.004 1977< -.003 1899> -.003 2000> -.003 Higher 1843 .008 1934 .006

1408A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1811 61 66 63 75 91 55 76 40 59

1820 49 58 40 56 85 65 58 98 71 50

1830 82 55 70 84 81 81 46 72 54 71

1840 51 62 114 42 74 61 67 58 52 53

1850 86 67 51 81 73 84 50 118 96 88

1860 138 169 182 255 201 256 242 204 133 153

1870 155 123 133 72 177 111 98 77 93 70

1880 134 112 166 105 149 98 180 119 116 223

1890 202 199 161 118 77 83 117 214 174 156

1900 161 211 248 250 165 214 195 173 106 56

1910 95 77 81 115 123 143 157 145 110 134

1920 76 68 95 77 100 93 97 104 111 114

1930 114 87 62 69 42 65 45 79 70 69

1940 62 51 46 55 55 69 76 77 22 64

1950 47 85 67 85 79 67 53 68 47 55

1960 46 60 48 65 54 41 61 77 88 68

1970 48 55 62 92 71 55 58 41 48 65

1980 70 59 62 71 57 66 102 91 49 87

1990 83 86 84 71 64 53 95 79 114 83

2000 113 125 99 70 104 124 96 96 111 129

2010 135 95 122 172 120 108 115

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1408B 1811 to 2016 206 years Series 32

[B] Entire series, effect on correlation ( .815) is:

Lower 1879< -.006 1990< -.005 1856> -.005 2005< -.004 1817< -.004 1957< -.004 Higher 1948 .007 1843 .007

1408B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1811 66 67 81 106 82 52 54 46 69

1820 49 56 54 58 73 78 51 82 59 47

1830 88 60 73 77 75 75 43 49 69 63

1840 40 62 92 34 53 49 44 56 45 54

1850 59 72 42 54 46 66 78 127 101 79

1860 111 126 154 222 244 271 233 210 115 147

1870 166 121 202 141 213 118 122 102 109 67

1880 137 99 130 79 124 81 194 178 125 197

1890 162 216 289 182 233 154 143 247 181 135

1900 190 296 288 308 246 326 362 309 145 104

1910 186 132 131 207 210 367 350 289 182 199

1920 124 92 131 105 141 184 205 227 209 217

1930 180 144 102 111 64 82 96 153 103 95

1940 102 88 53 77 69 113 118 103 35 60

1950 41 92 71 57 119 81 56 65 53 48

1960 49 88 67 69 63 52 75 98 101 124

1970 75 91 87 140 100 99 110 80 79 79

1980 84 73 75 85 87 79 117 106 67 84

1990 68 78 71 66 72 50 74 56 80 67

2000 70 88 82 54 65 84 88 91 88 152

2010 162 110 149 172 133 124 120

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[\*] All segments correlate highest as dated with correlation with master series over .3281

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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 1139A 1904 2016 113 4 0 .660 1.18 2.87 .550 .665 .299 2.51 .321 -.005 1

2 1139B 1883 2016 134 5 0 .575 .87 2.55 .519 .798 .327 2.45 .315 -.032 1

3 1140A 1862 2016 155 6 0 .631 1.06 2.65 .454 .678 .269 2.85 .465 -.012 1

4 1140B 1835 2016 182 7 0 .694 1.12 3.65 .541 .773 .257 2.57 .307 -.019 1

5 1141A 1838 2016 179 7 0 .733 1.06 4.20 .700 .889 .219 2.62 .346 -.072 1

6 1141B 1847 2016 170 7 0 .673 .97 4.29 .643 .869 .236 2.64 .474 -.071 1

7 1142A 1845 2016 172 7 0 .731 .94 4.79 .691 .850 .264 2.81 .425 -.067 1

8 1142B 1853 2016 164 6 0 .672 .83 2.84 .410 .777 .243 2.70 .377 -.096 1

9 1143A 1839 2016 178 7 0 .772 1.28 5.20 .940 .867 .218 2.67 .361 -.097 1

10 1143B 1837 2016 180 7 0 .688 1.33 5.17 1.031 .887 .241 2.47 .263 -.002 2

11 1144A 1826 2016 191 7 0 .734 1.05 3.94 .547 .829 .212 2.57 .358 -.028 1

12 1144B 1831 2016 186 7 0 .741 1.22 4.49 .670 .801 .237 2.59 .325 -.075 1

13 1145A 1876 2016 141 5 0 .666 1.49 4.23 .734 .758 .263 2.57 .421 .008 1

14 1145B 1879 2016 138 5 0 .727 1.11 3.75 .629 .776 .274 2.79 .484 .004 1

15 1146A 1883 2016 134 5 0 .796 1.75 6.21 .899 .743 .268 2.89 .489 -.043 1

16 1146B 1927 2016 90 3 0 .691 1.21 3.25 .577 .666 .304 2.54 .355 -.095 1

17 1401A 1838 2016 179 7 0 .812 .71 1.59 .262 .600 .265 2.90 .440 -.058 1

18 1401B 1816 2016 201 8 0 .745 .99 3.09 .496 .770 .268 2.55 .289 -.038 1

19 1402A 1826 2016 191 7 0 .717 .99 2.92 .559 .809 .248 2.49 .279 -.027 2

20 1402B 1798 2016 219 8 0 .698 1.13 3.40 .617 .838 .252 2.75 .431 -.015 1

21 1403A 1919 2016 98 4 0 .782 .88 1.85 .306 .752 .187 2.64 .458 -.074 1

22 1403B 1905 2016 112 4 0 .769 1.48 3.50 .544 .710 .195 2.68 .403 -.030 1

23 1404A 1852 2016 165 6 0 .683 1.48 4.48 .773 .845 .201 2.91 .620 -.035 1

24 1404B 1825 2016 192 7 0 .677 1.22 2.96 .532 .695 .266 2.65 .360 -.063 1

25 1405A 1828 2016 189 7 0 .783 1.04 2.76 .493 .763 .252 2.58 .373 -.056 1

26 1405B 1826 2016 191 7 0 .796 .89 3.44 .443 .713 .247 2.63 .303 .003 2

27 1406A 1865 2016 152 6 0 .791 .74 2.26 .425 .819 .261 2.62 .343 -.014 3

28 1406B 1861 2016 156 6 0 .735 1.02 2.96 .507 .755 .272 2.59 .395 -.042 3

29 1407A 1822 2016 195 8 0 .739 1.22 4.98 .726 .811 .245 2.78 .435 -.053 1

30 1407B 1856 2016 161 6 0 .830 1.64 5.99 .910 .781 .234 2.73 .447 -.007 1

31 1408A 1811 2016 206 8 0 .799 .96 2.56 .482 .785 .263 2.67 .361 -.059 1

32 1408B 1811 2016 206 8 0 .815 1.16 3.67 .692 .826 .261 2.75 .452 -.079 1

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Total or mean: 5320 202 0 .732 1.12 6.21 .607 .783 .251 2.91 .387 -.042

- = [ COFECHA BB COF ] = -