[] Dendrochronology Program Library Run BEAL Program COF 15:35 Mon 14 Aug 2017 Page 1

[] P R O G R A M C O F E C H A Version 6.06P 30178

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: HHSI01A11\_BEAL\_Corr3-50

File of DATED series: HHSI01A11\_BEAL\_Corr3

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 1853 to 2015 163 years

Continuous time span is 1853 to 2015 163 years

Portion with two or more series is 1861 to 2015 155 years

>> 1272B 1983 absent in 1 of 37 series, but is not usually narrow: master index is .518

>> 1468B 1988 absent in 1 of 37 series, but is not usually narrow: master index is -.145

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*C\* Number of dated series 37 \*C\*

\*O\* Master series 1853 2015 163 yrs \*O\*\*F\* Total rings in all series 3670 \*F\*

\*E\* Total dated rings checked 3662 \*E\*\*C\* Series intercorrelation .561 \*C\*

\*H\* Average mean sensitivity .340 \*H\* \*A\* Segments, possible problems 12 \*A\*

\*\*\* Mean length of series 99.2 \*\*\* \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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

1272A 3 absent rings: 1965 1981 1986

1272B 2 absent rings: 1983 1986

1282B 1 absent rings: 1965

1282C 1 absent rings: 1965

1287A 1 absent rings: 2001

1287B 1 absent rings: 2001

1466A 1 absent rings: 1981

1468B 1 absent rings: 1988

1485A 1 absent rings: 1981

1485B 1 absent rings: 1981

1494A 1 absent rings: 1981

14 absent rings .381%

PART 2: TIME PLOT OF TREE-RING SERIES: HHSI01A11\_BEAL\_Corr3-50 15:35 Mon 14 Aug 2017 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

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

. . . . . . . . . . . . . . . . . .<=========> . 1272A 1 1912 2015 104

. . . . . . . . . . . . . . . . . .<=========> . 1272B 2 1910 2015 106

. . . . . . . . . . . . . . . . . . <=====> . 1276A 3 1957 2015 59

. . . . . . . . . . . . . . . . . . .<====> . 1276B 4 1962 2015 54

. . . . . . . . . . . . . . . . . . <=======> . 1282A 5 1930 2015 86

. . . . . . . . . . . . . . . . . . <=======> . 1282B 6 1936 2015 80

. . . . . . . . . . . . . . . . . . <=======> . 1282C 7 1939 2015 77

. . . . . . . . . . . . . . . . . <============> . 1287A 8 1882 2015 134

. . . . . . . . . . . . . . . . . <===========> . 1287B 9 1893 2015 123

. . . . . . . . . . . . . . . . . . <========> . 1366A 10 1926 2015 90

. . . . . . . . . . . . . . . . . .<=========> . 1366B 11 1913 2015 103

. . . . . . . . . . . . . . . . . <==========> . 1460A 12 1902 2015 114

. . . . . . . . . . . . . . . . . .<=========> . 1460B 13 1910 2015 106

. . . . . . . . . . . . . . . . . . <=======> . 1466A 14 1933 2015 83

. . . . . . . . . . . . . . . . . . <========> . 1466B 15 1927 2015 89

. . . . . . . . . . . . . . . . . . <======> . 1467A 16 1944 2015 72

. . . . . . . . . . . . . . . . . . <=======> . 1467B 17 1934 2015 82

. . . . . . . . . . . . . . . . .<==============> . 1468A 18 1865 2015 151

. . . . . . . . . . . . . . . . .<==============> . 1468B 19 1861 2015 155

. . . . . . . . . . . . . . . . <===============> . 1469A 20 1853 2015 163

. . . . . . . . . . . . . . . . .<==============> . 1469B 21 1862 2015 154

. . . . . . . . . . . . . . . . . . <======> . 1470A 22 1943 2015 73

. . . . . . . . . . . . . . . . . . <======> . 1470B 23 1948 2015 68

. . . . . . . . . . . . . . . . . .<=========> . 1471A 24 1916 2015 100

. . . . . . . . . . . . . . . . . .<=========> . 1471B 25 1916 2015 100

. . . . . . . . . . . . . . . . . . <========> . 1484A 26 1923 2015 93

. . . . . . . . . . . . . . . . . . <=======> . 1484B 27 1933 2015 83

. . . . . . . . . . . . . . . . .<==============> . 1485A 28 1866 2015 150

. . . . . . . . . . . . . . . . . <==========> . 1485B 29 1902 2015 114

. . . . . . . . . . . . . . . . . . <======> . 1489A 30 1940 2015 76

. . . . . . . . . . . . . . . . . . <======> . 1489B 31 1947 2015 69

. . . . . . . . . . . . . . . . . . <======> . 1490A 32 1942 2015 74

. . . . . . . . . . . . . . . . . . <========> . 1490B 33 1920 2015 96

. . . . . . . . . . . . . . . . . <==========> . 1494A 34 1906 2015 110

. . . . . . . . . . . . . . . . . .<=========> . 1494B 35 1910 2015 106

. . . . . . . . . . . . . . . . . . <=======> . 1495A 36 1932 2015 84

. . . . . . . . . . . . . . . . . . <========> . 1495B 37 1927 2015 89

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

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

1900 -.577 7 1950 .501 35 2000 -.802 37

1901 .026 7 1951 .754 35 2001 -2.729 37 2

1902 -.432 9 1952 .748 35 2002 -.237 37

1853 -2.142 1 1903 1.161 9 1953 .314 35 2003 -1.398 37

1854 -.297 1 1904 -.473 9 1954 -.122 35 2004 -.758 37

1855 -1.829 1 1905 -1.368 9 1955 .728 35 2005 .433 37

1856 .097 1 1906 -.311 10 1956 .216 35 2006 -.731 37

1857 1.096 1 1907 1.246 10 1957 -.861 36 2007 -.198 37

1858 1.922 1 1908 .781 10 1958 -1.206 36 2008 .586 37

1859 1.054 1 1909 .963 10 1959 -.383 36 2009 .259 37

1860 -2.033 1 1910 1.713 13 1960 .559 36 2010 1.527 37

1861 -.117 2 1911 .879 13 1961 1.744 36 2011 .996 37

1862 .538 3 1912 -2.007 14 1962 .921 37 2012 1.049 37

1863 1.563 3 1913 -.280 15 1963 1.525 37 2013 -1.141 37

1864 1.194 3 1914 -.980 15 1964 -2.327 37 2014 .183 37

1865 1.030 4 1915 .584 15 1965 -2.879 37 3 2015 -.240 37

1866 .334 5 1916 -.260 17 1966 -.863 37

1867 1.166 5 1917 .212 17 1967 -.044 37

1868 -1.844 5 1918 -1.866 17 1968 -.178 37

1869 -.933 5 1919 -.352 17 1969 .796 37

1870 -.129 5 1920 .462 18 1970 .805 37

1871 .553 5 1921 -.691 18 1971 .830 37

1872 -3.044 5 1922 -.773 18 1972 .622 37

1873 .368 5 1923 -.011 19 1973 .806 37

1874 -.122 5 1924 1.077 19 1974 .695 37

1875 .709 5 1925 1.426 19 1975 -.150 37

1876 -.629 5 1926 .228 20 1976 .800 37

1877 .105 5 1927 -.195 22 1977 .274 37

1878 -1.752 5 1928 .199 22 1978 .457 37

1879 .214 5 1929 .030 22 1979 .063 37

1880 .973 5 1930 .521 23 1980 -1.990 37

1881 .956 5 1931 .592 23 1981 -2.547 37 5

1882 -.928 6 1932 -.085 24 1982 -.185 37

1883 .938 6 1933 -.042 26 1983 .518 37 1<<

1884 -.259 6 1934 .573 27 1984 .174 37

1885 1.097 6 1935 .659 27 1985 -.527 37

1886 -.231 6 1936 -2.846 28 1986 -.730 37 2

1887 1.091 6 1937 -.218 28 1987 .441 37

1888 .233 6 1938 -.200 28 1988 -.145 37 1<<

1889 .715 6 1939 .468 29 1989 .112 37

1890 .286 6 1940 .030 30 1990 .349 37

1891 -.230 6 1941 -.872 30 1991 .447 37

1892 .488 6 1942 -.792 31 1992 -.635 37

1893 .020 7 1943 .791 32 1993 -.194 37

1894 .933 7 1944 -1.072 33 1994 1.117 37

1895 -1.635 7 1945 .593 33 1995 .798 37

1896 -.176 7 1946 .038 33 1996 .733 37

1897 -1.709 7 1947 .876 34 1997 .861 37

1898 .306 7 1948 -1.612 35 1998 .595 37

1899 .599 7 1949 -.468 35 1999 .990 37

PART 5: CORRELATION OF SERIES BY SEGMENTS: HHSI01A11\_BEAL\_Corr3-50 15:35 Mon 14 Aug 2017 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 1850 1875 1900 1925 1950 1975

1899 1924 1949 1974 1999 2024

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

1 1272A 1912 2015 .26A .58 .57 .35

2 1272B 1910 2015 .52 .55 .65 .58

3 1276A 1957 2015 .64 .62

4 1276B 1962 2015 .63 .47

5 1282A 1930 2015 .70 .67 .41

6 1282B 1936 2015 .71 .66 .60

7 1282C 1939 2015 .72 .64 .65

8 1287A 1882 2015 .51 .63 .65 .46 .43

9 1287B 1893 2015 .61 .66 .70 .48 .39

10 1366A 1926 2015 .75 .75 .75

11 1366B 1913 2015 .58 .86 .87 .77

12 1460A 1902 2015 .56 .57 .45 .40

13 1460B 1910 2015 .27A .25B .35 .62

14 1466A 1933 2015 .80 .67 .62

15 1466B 1927 2015 .60 .53 .59

16 1467A 1944 2015 .42 .54 .55

17 1467B 1934 2015 .40 .54 .59

18 1468A 1865 2015 .58 .60 .48 .45 .41 .47

19 1468B 1861 2015 .41 .57 .69 .64 .44 .33A

20 1469A 1853 2015 .51 .28A .23B .37 .54 .51

21 1469B 1862 2015 .55 .47 .33 .42 .61 .55

22 1470A 1943 2015 .61 .57 .37

23 1470B 1948 2015 .63 .61 .57

24 1471A 1916 2015 .58 .58 .42 .61

25 1471B 1916 2015 .49 .44 .48 .47

26 1484A 1923 2015 .76 .77 .57 .51

27 1484B 1933 2015 .61 .55 .51

28 1485A 1866 2015 .59 .36 .29B .49 .62 .75

29 1485B 1902 2015 .46 .56 .68 .71

30 1489A 1940 2015 .58 .64 .52

31 1489B 1947 2015 .46 .45 .58

32 1490A 1942 2015 .65 .60 .30A

33 1490B 1920 2015 .69 .69 .65 .30A

34 1494A 1906 2015 .28A .78 .83 .51

35 1494B 1910 2015 .47 .63 .68 .65

36 1495A 1932 2015 .72 .58 .32A

37 1495B 1927 2015 .66 .56 .24A

Av segment correlation .53 .49 .49 .60 .58 .52

PART 6: POTENTIAL PROBLEMS: HHSI01A11\_BEAL\_Corr3-50 15:35 Mon 14 Aug 2017 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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1272A 1912 to 2015 104 years Series 1

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

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

1912 1961 0 .13 .17 -.08 -.02 -.21 .13 .03 -.08 -.03 .24 .26\*-.07 -.07 .03 .02 .05 -.06 -.16 .24 -.06 .13

[B] Entire series, effect on correlation ( .380) is:

Lower 1912> -.081 1986< -.043 1948> -.035 1913< -.020 1974< -.017 1943< -.008 Higher 1964 .071 1936 .048

1912 to 1961 segment:

Lower 1912> -.176 1948> -.071 1913< -.050 1943< -.019 1951< -.013 1915< -.012 Higher 1936 .168 1961 .033

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

1985 1986 -4.0 SD

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

1965 -2.879 37 3

1981 -2.547 37 5

1986 -.730 37 2

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

1912 +3.7 SD; 1948 +3.4 SD

1272A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1912 111 25 33 34 32 63 70 55

1920 137 85 63 108 191 262 144 126 121 166

1930 164 165 90 64 107 144 29 47 18 17

1940 3 5 6 4 5 13 18 49 47 27

1950 21 11 19 15 11 11 14 15 12 34

1960 52 65 48 51 3 0 30 36 42 42

1970 24 27 24 18 4 6 13 4 12 7

1980 4 0 10 8 8 11 0 5 4 7

1990 15 24 16 18 31 60 53 69 48 45

2000 40 39 35 41 63 114 123 175 216 344

2010 339 200 143 89 114 151

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1272B 1910 to 2015 106 years Series 2

[B] Entire series, effect on correlation ( .588) is:

Lower 1948> -.033 1983< -.018 1998< -.016 1930< -.014 1915< -.011 1944> -.010 Higher 1964 .050 1912 .040

[D] 2 Absent rings: Year Master N series Absent

1983 .518 37 1 >> WARNING: Ring is not usually narrow

1986 -.730 37 2

1272B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1910 136 161 40 88 88 58 71 87 8 64

1920 119 98 113 176 277 282 183 141 136 95

1930 38 64 17 36 46 52 17 36 54 49

1940 19 22 22 33 33 98 74 49 58 39

1950 32 37 26 24 15 29 39 35 53 109

1960 106 191 229 189 37 19 64 87 116 193

1970 180 130 186 264 267 172 119 132 116 113

1980 37 37 41 0 12 10 0 4 4 13

1990 21 16 10 4 25 20 45 86 43 53

2000 54 22 30 24 31 108 87 111 102 186

2010 285 249 345 234 237 162

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1276A 1957 to 2015 59 years Series 3

[B] Entire series, effect on correlation ( .628) is:

Lower 1966< -.037 1965> -.034 1980< -.028 1981> -.009 1992> -.007 2012< -.007 Higher 1964 .035 2000 .013

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

1980 -5.1 SD

1276A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 294 289 298

1960 317 370 379 402 234 284 186 254 272 329

1970 334 324 306 422 327 266 337 275 240 207

1980 50 124 258 324 229 193 209 249 212 184

1990 165 189 196 190 227 222 254 199 209 260

2000 155 98 160 109 127 160 110 185 223 202

2010 191 175 125 85 87 94

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1276B 1962 to 2015 54 years Series 4

[B] Entire series, effect on correlation ( .567) is:

Lower 1977< -.038 2014< -.031 1987< -.024 2013> -.024 1992> -.021 1986> -.017 Higher 1964 .104 2001 .047

1276B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1962 343 423 221 309 427 444 312 366

1970 368 385 375 458 376 325 368 194 293 259

1980 156 218 239 292 402 308 386 257 321 307

1990 277 281 324 302 319 317 346 264 417 307

2000 212 107 245 167 246 258 210 188 242 277

2010 301 340 226 202 122 172

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1282A 1930 to 2015 86 years Series 5

[B] Entire series, effect on correlation ( .632) is:

Lower 1980> -.025 1933< -.018 1976< -.017 1936> -.013 1970< -.013 1984> -.012 Higher 1964 .101 2001 .016

1282A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 155 123 128 47 53 116 59 127 171 194

1940 89 34 40 54 18 79 54 61 46 76

1950 114 113 112 92 101 135 116 67 40 66

1960 97 176 122 177 34 5 35 61 44 86

1970 42 51 48 41 28 26 17 11 14 22

1980 37 35 62 73 105 63 30 62 41 76

1990 113 152 127 100 96 94 80 107 146 108

2000 81 34 39 45 69 83 84 137 171 240

2010 239 272 277 203 305 272

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1282B 1936 to 2015 80 years Series 6

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

Lower 1936> -.038 1956< -.031 1998> -.010 1984< -.009 2000> -.008 1986< -.008 Higher 1964 .048 1948 .022

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

1965 -2.879 37 3

1282B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1936 75 151 124 105

1940 107 44 30 42 14 50 36 47 15 21

1950 15 14 22 14 13 27 3 3 3 6

1960 46 71 61 70 13 0 26 35 43 47

1970 46 76 71 67 98 72 64 66 63 53

1980 45 36 71 85 54 56 40 52 40 63

1990 67 82 58 63 58 43 71 87 159 103

2000 76 35 38 38 43 64 43 57 99 140

2010 180 197 186 143 194 186

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1282C 1939 to 2015 77 years Series 7

[B] Entire series, effect on correlation ( .730) is:

Lower 1976< -.016 1986< -.014 1981> -.012 2002< -.010 1950< -.009 1956< -.009 Higher 1964 .035 1948 .015

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

1965 -2.879 37 3

1282C Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 142

1940 117 41 35 48 10 45 35 49 18 24

1950 16 12 31 14 11 26 8 10 12 16

1960 63 79 69 88 16 0 22 31 63 102

1970 64 80 68 56 88 73 47 54 50 47

1980 28 35 68 70 44 34 19 28 29 48

1990 38 63 37 33 36 25 57 72 94 83

2000 49 24 24 23 44 68 49 76 97 109

2010 154 162 149 108 168 173

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1287A 1882 to 2015 134 years Series 8

[B] Entire series, effect on correlation ( .560) is:

Lower 1882> -.010 1925< -.010 1890< -.010 1886< -.009 1889< -.009 1994< -.009 Higher 1936 .042 1948 .017

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

2001 -2.729 37 2

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

1918 -5.4 SD

1287A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1882 150 223 131 185 88 120 119 106

1890 91 114 181 150 157 120 146 142 197 213

1900 179 193 191 231 182 168 234 190 194 224

1910 306 236 95 72 100 115 90 101 5 90

1920 111 84 28 45 82 60 78 64 76 115

1930 121 183 125 144 143 140 29 59 85 121

1940 118 95 105 102 72 64 76 65 29 54

1950 84 98 109 87 72 110 64 75 50 54

1960 49 81 60 62 28 25 58 38 24 93

1970 157 145 146 95 116 109 97 109 125 144

1980 101 89 121 122 73 65 115 130 96 55

1990 43 63 48 117 57 63 52 75 25 56

2000 4 0 7 21 4 20 3 19 36 30

2010 63 92 164 72 91 86

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1287B 1893 to 2015 123 years Series 9

[B] Entire series, effect on correlation ( .584) is:

Lower 1922< -.026 1926> -.010 2013> -.010 1900> -.009 1986> -.009 1960< -.009 Higher 1936 .059 1912 .015

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

2001 -2.729 37 2

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

1936 -5.0 SD

1287B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1893 214 231 149 132 113 154 155

1900 189 203 186 183 158 145 203 169 160 153

1910 189 105 51 58 95 115 118 155 37 95

1920 126 133 29 106 146 145 191 154 163 144

1930 142 152 127 146 147 164 41 116 165 164

1940 156 107 93 142 85 112 118 130 79 108

1950 101 124 117 87 67 100 57 70 36 32

1960 25 72 50 92 23 19 88 30 25 43

1970 74 66 53 67 120 101 120 131 169 136

1980 34 19 48 83 87 94 141 78 75 24

1990 21 39 41 72 55 79 52 112 31 27

2000 3 0 12 18 6 34 14 17 52 39

2010 68 74 70 51 52 27

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1366A 1926 to 2015 90 years Series 10

[B] Entire series, effect on correlation ( .738) is:

Lower 1937< -.013 2013> -.011 1945< -.008 1990< -.007 1940> -.007 1986> -.007 Higher 1936 .050 1980 .013

1366A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 163 156 114 124

1930 196 147 98 113 94 78 6 31 93 102

1940 133 69 104 173 51 63 86 110 58 55

1950 85 113 80 76 98 145 144 109 124 148

1960 163 224 153 191 44 21 59 103 110 174

1970 152 132 183 183 172 108 110 104 103 71

1980 33 26 83 85 92 69 83 89 68 78

1990 51 64 40 41 91 53 57 56 55 53

2000 39 31 64 41 58 79 40 50 83 62

2010 107 68 76 72 91 87

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1366B 1913 to 2015 103 years Series 11

[B] Entire series, effect on correlation ( .704) is:

Lower 1917< -.084 1922> -.018 1945< -.012 1938> -.010 1924< -.009 1978< -.007 Higher 1964 .052 1936 .046

1366B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1913 69 57 90 94 64 69 104

1920 121 106 174 145 127 155 152 160 253 160

1930 222 196 129 80 112 125 13 65 179 150

1940 143 76 76 154 69 54 59 106 52 66

1950 92 111 110 107 91 107 116 93 56 75

1960 109 215 167 207 49 52 87 146 133 173

1970 153 170 205 266 250 190 189 117 78 73

1980 35 50 125 135 113 103 94 108 79 74

1990 92 122 58 75 150 123 160 148 83 92

2000 76 51 88 49 71 79 58 79 133 115

2010 153 136 111 89 108 112

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1460A 1902 to 2015 114 years Series 12

[B] Entire series, effect on correlation ( .534) is:

Lower 1910< -.020 1980> -.016 1926< -.013 1981> -.013 1904> -.011 2012< -.011 Higher 1912 .045 1948 .022

1460A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 230 223 231 151 194 267 219 157

1910 131 221 72 136 94 161 143 158 147 154

1920 199 129 127 181 291 270 94 164 163 204

1930 220 237 208 122 149 209 119 172 152 112

1940 71 88 104 156 125 137 108 155 60 72

1950 96 63 77 83 55 95 71 46 83 84

1960 119 127 81 69 12 13 16 22 32 71

1970 54 92 54 85 125 79 110 68 95 77

1980 77 80 80 67 77 44 27 62 87 65

1990 56 39 51 56 113 93 138 131 67 113

2000 75 73 137 80 99 125 74 114 127 228

2010 257 166 97 78 123 150

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1460B 1910 to 2015 106 years Series 13

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

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1910 1959 0 -.06 .14 -.10 -.19 -.18 .25 .14 .05 .06 -.14 .27\* .13 -.12 -.27 .17 .12 .04 -.07 .08 .03 -.15

1925 1974 -4 .01 .04 -.01 -.14 -.20 .15 .26\* .04 .06 -.07 .25| .08 -.16 -.26 -.10 .07 .04 -.06 .20 .02 -.16

[B] Entire series, effect on correlation ( .418) is:

Lower 1940< -.038 1944> -.025 1917< -.020 1948> -.014 1953< -.013 1991< -.011 Higher 2001 .020 2010 .015

1910 to 1959 segment:

Lower 1940< -.057 1944> -.043 1917< -.035 1948> -.022 1953< -.021 1939< -.012 Higher 1910 .028 1924 .021

1925 to 1974 segment:

Lower 1940< -.065 1944> -.048 1948> -.021 1953< -.020 1967< -.012 1939< -.012 Higher 1961 .035 1964 .024

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

1940 -4.7 SD

1460B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1910 546 458 287 343 177 285 316 201 189 227

1920 245 157 160 213 277 254 117 76 71 138

1930 129 112 90 110 114 74 46 66 70 49

1940 8 9 34 70 95 95 54 50 41 45

1950 49 50 65 29 51 61 54 35 44 24

1960 46 81 75 67 22 16 17 17 19 33

1970 47 50 31 35 38 25 74 49 55 57

1980 34 24 63 73 68 49 28 63 42 31

1990 33 21 28 23 27 28 27 37 43 50

2000 26 15 37 34 33 44 32 41 48 55

2010 82 57 61 37 58 54

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1466A 1933 to 2015 83 years Series 14

[B] Entire series, effect on correlation ( .748) is:

Lower 1964> -.026 1983< -.013 2000> -.011 2012< -.008 2013> -.008 1956< -.005 Higher 1936 .043 1948 .014

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

1981 -2.547 37 5

1466A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 97 104 132 12 73 84 116

1940 75 65 51 81 43 70 73 93 30 48

1950 85 72 62 68 64 64 37 47 64 62

1960 97 128 120 120 44 19 34 50 67 134

1970 76 67 73 76 71 59 79 81 84 85

1980 14 0 26 18 46 49 56 66 56 88

1990 107 108 76 74 135 128 148 138 135 130

2000 124 82 111 67 110 123 135 151 239 271

2010 235 188 133 113 131 113

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1466B 1927 to 2015 89 years Series 15

[B] Entire series, effect on correlation ( .598) is:

Lower 1957< -.036 1940> -.020 1983< -.012 2006> -.011 1955< -.008 2000> -.008 Higher 1936 .087 2001 .019

1466B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 114 277 107

1930 80 117 117 107 123 142 24 71 89 94

1940 158 70 57 82 55 57 42 65 42 37

1950 51 48 35 39 34 29 44 15 29 37

1960 29 45 33 40 21 17 34 64 64 90

1970 54 41 47 57 70 71 81 78 86 56

1980 12 6 31 22 51 51 45 72 49 70

1990 74 89 77 66 135 135 190 181 176 155

2000 127 49 114 70 121 136 177 120 213 264

2010 192 184 128 115 122 107

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

1467A 1944 to 2015 72 years Series 16

[B] Entire series, effect on correlation ( .492) is:

Lower 1949< -.048 1944> -.026 1980> -.021 1992< -.019 1946> -.013 1957> -.010 Higher 1964 .063 1981 .023

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

1948 1949 -4.2 SD

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

1949 -4.8 SD

1467A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 166 132 207 149 86 14

1950 54 87 89 101 97 110 105 110 89 109

1960 135 164 132 144 58 60 82 72 68 86

1970 93 142 107 112 113 112 151 172 216 231

1980 195 96 209 241 242 176 180 182 156 194

1990 180 202 86 107 182 210 214 156 146 141

2000 82 81 178 112 128 209 196 201 171 189

2010 206 197 171 140 163 145

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

1467B 1934 to 2015 82 years Series 17

[B] Entire series, effect on correlation ( .460) is:

Lower 1936> -.067 1984< -.037 1944> -.023 1938< -.018 1941> -.015 1949< -.013 Higher 1948 .021 2010 .015

1467B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1934 346 187 187 229 116 172

1940 127 168 102 85 138 183 110 159 79 33

1950 59 57 69 90 77 71 98 51 46 77

1960 96 124 104 113 62 37 51 87 93 93

1970 92 95 95 100 96 59 74 92 121 132

1980 84 50 120 125 40 41 55 83 67 73

1990 76 87 44 70 116 133 172 122 126 145

2000 91 71 116 70 88 131 98 151 205 234

2010 330 241 165 116 170 125

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1468A 1865 to 2015 151 years Series 18

[B] Entire series, effect on correlation ( .517) is:

Lower 1964> -.022 1936> -.016 1981> -.016 1988< -.012 1908< -.011 1905> -.009 Higher 1895 .014 1918 .011

1468A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1865 402 273 363 139 98

1870 117 121 64 164 99 129 126 163 78 142

1880 181 217 131 208 202 236 219 303 256 251

1890 231 198 195 181 319 144 222 202 266 220

1900 141 152 177 220 162 192 142 178 112 145

1910 218 188 99 115 109 157 139 181 63 61

1920 95 41 29 34 74 102 56 103 140 167

1930 200 226 217 157 141 110 69 62 43 38

1940 17 15 27 17 6 25 21 44 24 21

1950 49 54 31 29 29 41 52 39 40 42

1960 46 77 53 62 41 11 19 41 33 31

1970 44 49 43 39 46 20 67 39 48 28

1980 15 47 30 25 54 46 37 44 12 23

1990 54 52 52 98 136 118 136 105 88 115

2000 102 70 103 45 72 107 119 108 146 161

2010 176 117 90 60 100 92

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

1468B 1861 to 2015 155 years Series 19

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

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

1966 2015 0 .19 .05 -.10 -.05 .11 .01 -.33 -.27 -.08 -.11 .33\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .492) is:

Lower 1988< -.031 1992> -.014 1891> -.013 1873< -.012 1878> -.010 1980> -.008 Higher 1912 .029 1964 .018

1966 to 2015 segment:

Lower 1992> -.048 1988< -.039 1980> -.029 1974< -.020 1997< -.017 1994< -.013 Higher 2013 .058 2010 .037

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

1988 -.145 37 1 >> WARNING: Ring is not usually narrow

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

1988 -6.3 SD

1468B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1861 66 77 112 114 94 147 152 76 27

1870 44 54 18 24 32 108 119 132 125 245

1880 202 172 56 125 72 111 90 148 101 77

1890 70 163 194 153 157 83 115 69 102 70

1900 59 55 66 84 64 73 79 91 77 69

1910 107 83 28 41 68 109 67 85 28 57

1920 59 32 20 35 59 74 45 82 72 62

1930 66 55 48 48 49 49 25 32 16 24

1940 14 8 17 21 14 27 27 46 22 19

1950 22 40 28 25 26 42 37 32 26 24

1960 35 58 41 55 23 12 32 82 67 50

1970 50 55 69 46 25 15 57 38 44 33

1980 33 20 23 43 36 33 17 17 0 20

1990 27 27 37 34 23 17 21 16 15 18

2000 21 19 30 21 44 59 47 46 60 43

2010 69 51 56 47 58 69

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

1469A 1853 to 2015 163 years Series 20

[\*] Early part of series cannot be checked from 1853 to 1860 -- 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

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

1875 1924 0 .14 .13 .25 .13 .10 -.05 .11 -.19 .20 -.19 .28\*-.16 .10 -.17 .05 -.28 .00 .09 .02 -.02 .02

1900 1949 -6 .09 .10 .15 .02 .32\*-.04 .09 -.22 .10 -.09 .23| .01 .21 -.24 -.21 -.34 .12 .14 -.07 -.04 .04

[B] Entire series, effect on correlation ( .419) is:

Lower 1920< -.029 1942< -.025 1936> -.020 1895> -.019 1935< -.017 1879< -.010 Higher 1872 .038 1964 .020

1875 to 1924 segment:

Lower 1920< -.093 1895> -.052 1879< -.031 1894< -.027 1892< -.016 1884> -.009 Higher 1878 .024 1883 .021

1900 to 1949 segment:

Lower 1920< -.063 1936> -.048 1935< -.037 1942< -.030 1944> -.021 1934< -.012 Higher 1948 .041 1907 .020

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

1935 1936 4.6 SD

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

1942 -4.9 SD

1469A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1853 42 54 45 60 72 86 74

1860 45 71 88 94 90 73 54 64 40 48

1870 45 67 31 60 73 73 52 53 42 41

1880 52 82 64 99 82 90 67 83 79 89

1890 81 52 54 54 53 69 86 68 71 94

1900 81 79 52 102 57 42 71 121 122 135

1910 122 105 85 113 105 152 128 155 111 123

1920 63 66 78 103 103 117 94 98 120 114

1930 145 140 144 121 87 57 86 90 123 108

1940 102 98 41 106 107 116 60 93 56 77

1950 110 128 129 67 110 167 94 92 56 130

1960 139 200 95 129 40 38 62 53 38 106

1970 116 102 98 146 124 59 113 123 105 77

1980 61 71 66 129 41 50 28 63 42 40

1990 77 62 75 69 83 55 31 48 47 62

2000 23 26 50 24 11 43 9 15 37 15

2010 69 63 62 23 34 10

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

1469B 1862 to 2015 154 years Series 21

[B] Entire series, effect on correlation ( .500) is:

Lower 1936> -.047 1921< -.024 1869> -.014 1935< -.012 1891> -.009 1981> -.008 Higher 1872 .032 1964 .028

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

1921 1922 4.5 SD 1935 1936 5.0 SD

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

1921 -6.6 SD

1469B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1862 134 151 137 148 109 131 80 175

1870 161 163 73 172 153 187 89 115 96 114

1880 150 136 114 114 89 109 102 140 132 165

1890 170 176 170 136 149 133 119 89 134 155

1900 161 173 162 170 124 124 133 181 172 154

1910 161 144 79 130 109 108 104 128 102 108

1920 81 17 98 106 166 159 169 152 135 143

1930 166 159 138 63 70 35 101 93 56 55

1940 57 58 30 53 68 101 73 101 59 76

1950 114 106 111 90 59 114 79 76 54 133

1960 121 172 94 107 20 34 69 46 27 97

1970 135 142 80 102 134 134 175 142 100 57

1980 47 78 55 81 28 14 42 57 63 59

1990 81 88 64 64 109 82 68 106 83 92

2000 37 35 80 28 26 79 32 36 54 32

2010 91 91 92 65 87 55

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

1470A 1943 to 2015 73 years Series 22

[B] Entire series, effect on correlation ( .587) is:

Lower 1974< -.026 1971< -.021 2006> -.019 2007< -.017 2010< -.013 1989< -.011 Higher 1964 .075 1948 .038

1470A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 150 113 134 82 97 30 72

1950 91 105 203 151 145 140 77 53 63 127

1960 110 132 138 163 76 58 146 207 209 252

1970 230 138 167 185 105 136 196 246 193 180

1980 111 106 106 87 120 78 68 82 117 78

1990 92 96 98 113 230 278 239 226 272 266

2000 206 131 198 177 180 261 297 194 282 362

2010 286 298 251 200 204 204

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

1470B 1948 to 2015 68 years Series 23

[B] Entire series, effect on correlation ( .642) is:

Lower 1960< -.025 1957> -.021 1950< -.019 1997< -.016 1983< -.014 1985> -.011 Higher 1964 .118 1948 .022

1470B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1948 98 227

1950 143 199 221 175 137 128 175 191 155 193

1960 119 180 127 131 53 28 71 148 138 131

1970 115 181 159 182 173 194 205 211 174 142

1980 67 48 78 57 96 153 176 211 163 114

1990 109 110 74 110 164 163 117 94 91 197

2000 127 104 183 140 193 236 150 159 305 345

2010 291 210 173 127 187 170

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1471A 1916 to 2015 100 years Series 24

[B] Entire series, effect on correlation ( .571) is:

Lower 1996< -.026 1921> -.019 1986> -.011 1952< -.009 1988> -.008 1955< -.008 Higher 1936 .039 2001 .025

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

2001 -5.2 SD

1471A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 105 106 56 89

1920 104 145 135 139 119 81 91 41 24 19

1930 39 28 22 21 70 100 39 48 42 36

1940 57 44 44 49 25 33 39 34 27 37

1950 83 80 43 57 64 45 36 28 29 34

1960 80 103 64 62 29 32 58 73 98 122

1970 156 179 98 104 105 77 77 38 51 66

1980 65 47 142 291 283 197 370 346 446 410

1990 303 295 196 222 253 199 86 170 212 227

2000 108 17 103 164 210 210 158 213 230 285

2010 284 299 415 197 225 190

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1471B 1916 to 2015 100 years Series 25

[B] Entire series, effect on correlation ( .482) is:

Lower 1938< -.064 1921> -.012 1926> -.012 1977< -.012 1925< -.011 2006> -.010 Higher 1964 .030 1936 .027

1471B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 41 58 17 37

1920 71 85 88 99 98 69 107 63 40 56

1930 63 66 54 87 130 124 56 94 17 35

1940 93 95 66 102 58 57 58 67 48 58

1950 96 118 117 121 78 79 61 34 36 43

1960 62 95 74 56 23 24 47 34 61 46

1970 41 40 24 38 70 57 50 18 26 31

1980 24 28 81 108 74 71 142 137 260 319

1990 291 438 377 412 346 176 135 207 254 307

2000 114 16 155 142 251 183 308 363 413 482

2010 505 464 443 237 328 285

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1484A 1923 to 2015 93 years Series 26

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

Lower 1981< -.031 1980> -.015 1982< -.013 1992> -.011 1953> -.010 1930< -.008 Higher 1936 .045 1964 .033

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

1980 1981 -4.0 SD

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

1981 -4.8 SD

1484A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1923 91 88 100 55 84 96 107

1930 62 54 45 64 69 86 16 72 108 102

1940 43 33 45 171 59 124 108 133 85 110

1950 140 153 171 252 155 130 116 61 54 81

1960 116 163 179 188 45 54 118 183 183 184

1970 187 173 153 197 179 126 177 151 118 127

1980 108 11 40 67 69 77 85 100 127 112

1990 162 121 133 137 205 174 113 103 142 166

2000 117 92 174 110 103 126 150 166 133 132

2010 162 181 270 148 169 201

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1484B 1933 to 2015 83 years Series 27

[B] Entire series, effect on correlation ( .587) is:

Lower 1981< -.079 1956> -.012 2003> -.008 1998< -.007 2006> -.007 1937< -.006 Higher 1964 .030 1948 .020

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

1980 1981 -4.1 SD

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

1981 -6.4 SD

1484B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 53 32 54 15 29 47 76

1940 109 43 45 110 30 86 93 127 73 120

1950 156 132 160 200 149 156 234 133 118 153

1960 194 198 217 224 77 70 137 223 214 219

1970 185 176 165 157 180 116 158 167 140 145

1980 90 8 85 135 164 111 118 128 132 101

1990 111 89 104 111 154 178 170 117 50 81

2000 74 66 180 203 170 258 191 222 180 118

2010 149 140 227 170 196 174

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1485A 1866 to 2015 150 years Series 28

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

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

1900 1949 -5 .03 -.02 .00 -.11 -.12 .35\* .00 -.19 -.10 -.02 .29|-.10 -.14 -.21 -.01 -.11 -.02 .10 -.12 .20 .22

[B] Entire series, effect on correlation ( .561) is:

Lower 1912> -.029 1944> -.020 1936> -.017 1891< -.014 1918> -.014 1927< -.012 Higher 1872 .037 1895 .019

1900 to 1949 segment:

Lower 1912> -.060 1944> -.052 1927< -.031 1918> -.027 1921> -.026 1917< -.008 Higher 1910 .036 1948 .026

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

1981 -2.547 37 5

1485A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1866 96 106 39 52

1870 115 127 43 108 82 72 61 70 53 98

1880 103 63 46 69 76 129 127 98 66 118

1890 123 52 59 69 89 40 73 68 73 99

1900 69 103 84 123 103 84 126 168 190 224

1910 314 289 262 289 254 273 194 178 219 198

1920 203 264 247 223 272 327 216 161 188 181

1930 221 207 184 210 241 222 204 198 197 262

1940 262 207 217 300 351 395 312 287 186 163

1950 144 167 151 117 106 175 149 148 120 97

1960 115 157 115 227 107 87 114 184 188 230

1970 279 237 251 180 174 133 101 82 63 37

1980 6 0 10 23 12 8 16 42 30 55

1990 60 57 11 21 18 34 18 36 33 49

2000 26 8 54 45 45 63 35 38 70 53

2010 90 88 111 57 79 58

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

1485B 1902 to 2015 114 years Series 29

[B] Entire series, effect on correlation ( .612) is:

Lower 1918> -.038 1944> -.030 1974< -.012 1923< -.009 1928< -.009 1922> -.007 Higher 1912 .036 1964 .027

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

1981 -2.547 37 5

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

1918 +3.3 SD

1485B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 84 141 113 90 126 163 146 138

1910 173 108 35 70 103 156 131 204 224 189

1920 211 165 183 107 130 171 145 120 96 87

1930 109 126 116 145 141 157 122 119 117 199

1940 212 179 161 247 279 299 215 178 120 243

1950 188 170 151 170 134 173 120 88 57 96

1960 116 204 140 174 49 66 77 198 109 118

1970 113 86 56 50 21 22 26 22 25 31

1980 19 0 27 36 23 14 22 51 60 46

1990 72 97 54 60 122 114 63 79 68 114

2000 34 11 60 58 74 101 49 49 71 49

2010 136 107 133 73 96 85

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

1489A 1940 to 2015 76 years Series 30

[B] Entire series, effect on correlation ( .574) is:

Lower 1948> -.031 1959< -.015 1961< -.014 1992> -.014 2015> -.013 1981> -.012 Higher 1964 .138 1980 .021

1489A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 335 137 187 223 156 134 142 272 250 429

1950 348 308 278 147 117 149 110 98 73 38

1960 81 67 60 72 21 30 37 26 26 28

1970 43 67 73 57 43 42 76 104 91 95

1980 41 71 230 289 184 188 103 170 125 120

1990 78 110 143 119 199 193 193 144 189 185

2000 55 39 60 52 64 48 36 47 87 60

2010 116 112 124 81 152 210

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

1489B 1947 to 2015 69 years Series 31

[B] Entire series, effect on correlation ( .558) is:

Lower 1981> -.045 1964> -.034 1992> -.026 1984< -.014 1972< -.009 1949> -.008 Higher 2013 .035 1980 .034

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

1964 +3.2 SD

1489B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 341 264 344

1950 325 313 252 177 143 184 200 112 109 148

1960 209 205 214 289 174 93 72 85 69 90

1970 81 75 61 60 81 80 88 94 89 83

1980 46 87 151 131 61 75 48 94 68 61

1990 99 171 219 161 231 249 185 161 175 142

2000 31 20 53 45 79 107 99 169 200 188

2010 350 383 406 203 307 274

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

1490A 1942 to 2015 74 years Series 32

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

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

1966 2015 0 .13 -.05 .03 .16 .03 .00 -.12 .09 -.13 -.23 .30\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .600) is:

Lower 2000> -.027 1984> -.025 1981> -.021 1971< -.016 1974< -.015 1995< -.012 Higher 1964 .119 2013 .017

1966 to 2015 segment:

Lower 2000> -.044 1984> -.041 1981> -.031 1971< -.027 1974< -.026 1986> -.021 Higher 2013 .073 1992 .052

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

1984 +3.3 SD

1490A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1942 183 190 90 161 146 150 114 149

1950 205 220 212 207 203 184 185 154 165 190

1960 226 242 234 278 107 88 175 136 179 212

1970 235 170 194 227 180 215 203 238 275 243

1980 221 260 272 292 432 293 335 334 292 262

1990 256 198 129 181 238 183 204 199 251 282

2000 272 220 293 234 216 262 196 199 198 201

2010 259 242 278 207 294 288

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

1490B 1920 to 2015 96 years Series 33

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

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

1966 2015 0 -.01 -.06 -.16 -.04 .01 .16 .04 .17 -.12 -.03 .30\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .558) is:

Lower 2000> -.037 2013> -.028 1991< -.021 1941> -.014 2009< -.011 1958> -.011 Higher 1964 .088 1936 .050

1966 to 2015 segment:

Lower 2000> -.086 2013> -.059 1991< -.043 1969< -.022 2009< -.020 2015> -.013 Higher 1980 .054 1992 .047

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

2000 +3.1 SD

1490B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1920 411 315 341 315 348 333 218 209 231 151

1930 139 124 144 110 116 140 82 103 101 115

1940 142 147 160 155 102 122 108 116 82 170

1950 176 163 163 151 178 181 217 178 222 297

1960 235 288 157 197 68 61 122 140 124 115

1970 147 159 228 191 184 147 215 176 180 215

1980 190 204 241 308 277 262 272 309 285 322

1990 339 250 199 272 333 309 351 285 397 406

2000 477 284 404 245 221 216 206 174 191 135

2010 197 218 307 292 248 288

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

1494A 1906 to 2015 110 years Series 34

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

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

1906 1955 0 .08 .10 .04 .04 .05 -.10 -.03 -.10 .11 -.03 .28\*-.06 -.06 -.21 -.11 -.09 .20 .05 .25 -.19 .14

[B] Entire series, effect on correlation ( .496) is:

Lower 1906< -.045 1918> -.042 1912> -.036 1911< -.031 2008< -.023 1928< -.011 Higher 1964 .080 1936 .029

1906 to 1955 segment:

Lower 1906< -.085 1918> -.079 1911< -.056 1912> -.055 1928< -.020 1932> -.007 Higher 1936 .118 1948 .046

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

1981 -2.547 37 5

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

1918 +3.6 SD

1494A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 96 158 171 225

1910 187 111 147 188 154 195 148 193 241 154

1920 192 138 94 73 96 180 136 105 37 44

1930 63 94 137 143 148 126 26 33 20 28

1940 33 30 40 56 16 44 73 64 34 46

1950 85 94 104 119 106 111 152 79 65 91

1960 95 114 117 154 42 42 37 50 55 85

1970 112 113 108 89 111 76 127 113 103 66

1980 28 0 26 35 30 18 16 28 16 25

1990 25 24 14 17 16 21 26 25 19 24

2000 12 12 18 33 46 56 51 105 57 39

2010 86 75 94 80 147 182

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

1494B 1910 to 2015 106 years Series 35

[B] Entire series, effect on correlation ( .583) is:

Lower 1918> -.031 1965> -.028 1998< -.014 1936> -.009 1919< -.009 1921> -.009 Higher 1964 .092 1948 .020

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

1964 1965 4.7 SD

1494B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1910 220 198 124 198 109 134 79 119 156 96

1920 158 162 146 118 124 127 163 135 147 152

1930 111 48 8 26 28 19 4 12 6 22

1940 12 22 30 49 5 59 60 63 17 33

1950 57 65 51 50 38 61 75 70 58 79

1960 94 100 134 127 74 130 143 165 156 171

1970 167 159 160 162 181 164 198 153 128 72

1980 45 17 50 45 79 66 55 109 89 100

1990 89 85 51 54 145 143 157 146 41 38

2000 25 16 50 64 95 136 102 145 166 163

2010 245 241 157 82 102 135

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

1495A 1932 to 2015 84 years Series 36

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

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

1966 2015 0 -.04 -.23 .00 .05 .13 .06 .09 .04 -.12 -.16 .32\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .582) is:

Lower 2001> -.055 2010< -.016 2000> -.013 1982< -.011 2003> -.011 2009< -.011 Higher 1936 .097 1948 .021

1966 to 2015 segment:

Lower 2001> -.138 2010< -.038 1982< -.029 2011< -.027 2009< -.025 2000> -.022 Higher 2013 .104 1981 .058

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

1936 -4.6 SD; 2001 +3.9 SD

1495A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 372 331 398 403 158 364 357 361

1940 289 257 316 307 237 319 240 255 151 210

1950 201 185 218 294 315 310 208 179 117 96

1960 167 196 219 294 160 115 256 259 214 253

1970 231 217 215 241 279 244 195 180 136 118

1980 59 19 21 35 61 56 62 107 109 124

1990 103 95 52 53 84 89 73 120 93 131

2000 118 154 157 127 110 107 82 79 76 47

2010 49 39 70 35 52 49

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

1495B 1927 to 2015 89 years Series 37

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

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

1966 2015 0 -.02 -.10 -.06 .03 -.14 -.26 -.01 -.01 .01 .13 .24\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .512) is:

Lower 2006> -.031 2000> -.027 2008< -.024 2009< -.010 1945< -.009 1947< -.009 Higher 1936 .125 1944 .011

1966 to 2015 segment:

Lower 2006> -.076 2000> -.060 2008< -.058 2009< -.021 1982< -.017 2010< -.016 Higher 1980 .063 1981 .053

1495B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 172 328 207

1930 262 317 278 283 356 358 82 271 311 296

1940 246 197 237 268 135 116 86 87 72 164

1950 152 266 271 293 320 318 185 168 96 93

1960 157 193 144 175 98 64 180 220 184 245

1970 252 200 234 248 242 150 113 102 76 68

1980 31 11 19 38 58 60 70 104 78 117

1990 71 60 48 46 47 47 49 71 75 72

2000 84 58 61 59 44 78 112 92 48 30

2010 41 50 76 56 56 44

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PART 7: DESCRIPTIVE STATISTICS: HHSI01A11\_BEAL\_Corr3-50 15:35 Mon 14 Aug 2017 Page 6

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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 1272A 1912 2015 104 4 1 .380 .59 3.44 .689 .861 .497 2.53 .360 -.035 1

2 1272B 1910 2015 106 4 0 .588 .88 3.45 .785 .835 .489 2.81 .402 -.056 1

3 1276A 1957 2015 59 2 0 .628 2.27 4.22 .845 .750 .227 2.41 .369 -.008 2

4 1276B 1962 2015 54 2 0 .567 2.93 4.58 .822 .509 .243 2.59 .503 -.010 1

5 1282A 1930 2015 86 3 0 .632 .94 3.05 .660 .807 .396 2.50 .390 .046 1

6 1282B 1936 2015 80 3 0 .677 .64 1.97 .470 .843 .397 2.89 .621 -.027 1

7 1282C 1939 2015 77 3 0 .730 .56 1.73 .403 .797 .443 2.66 .572 -.008 1

8 1287A 1882 2015 134 5 0 .560 1.00 3.06 .575 .766 .411 2.55 .370 -.020 1

9 1287B 1893 2015 123 5 0 .584 .96 2.31 .552 .751 .413 2.47 .326 -.019 1

10 1366A 1926 2015 90 3 0 .738 .93 2.24 .456 .643 .343 2.68 .471 .159 1

11 1366B 1913 2015 103 4 0 .704 1.14 2.66 .503 .612 .317 2.58 .489 .032 1

12 1460A 1902 2015 114 4 0 .534 1.17 2.91 .609 .697 .329 2.51 .392 -.034 1

13 1460B 1910 2015 106 4 2 .418 .84 5.46 .922 .904 .321 2.73 .475 -.002 3

14 1466A 1933 2015 83 3 0 .748 .89 2.71 .484 .771 .352 2.41 .349 -.041 1

15 1466B 1927 2015 89 3 0 .598 .84 2.77 .556 .720 .354 2.69 .414 -.041 1

16 1467A 1944 2015 72 3 0 .492 1.42 2.42 .518 .669 .247 2.47 .437 -.035 2

17 1467B 1934 2015 82 3 0 .460 1.12 3.46 .588 .686 .311 2.64 .521 -.032 2

18 1468A 1865 2015 151 6 0 .517 1.08 4.02 .785 .822 .349 2.64 .418 -.059 1

19 1468B 1861 2015 155 6 1 .492 .58 2.45 .421 .767 .368 2.61 .406 .014 1

20 1469A 1853 2015 163 6 2 .419 .79 2.00 .351 .622 .328 2.55 .407 -.029 1

21 1469B 1862 2015 154 6 0 .500 1.03 1.87 .439 .678 .319 2.45 .407 -.025 1

22 1470A 1943 2015 73 3 0 .587 1.60 3.62 .730 .777 .269 2.68 .472 .010 1

23 1470B 1948 2015 68 3 0 .642 1.53 3.45 .586 .617 .298 2.54 .460 .136 1

24 1471A 1916 2015 100 4 0 .571 1.23 4.46 1.015 .863 .329 2.68 .473 -.029 2

25 1471B 1916 2015 100 4 0 .482 1.29 5.05 1.243 .898 .363 2.49 .418 .002 1

26 1484A 1923 2015 93 4 0 .631 1.20 2.70 .514 .603 .323 2.60 .378 .053 1

27 1484B 1933 2015 83 3 0 .587 1.33 2.58 .579 .669 .343 2.40 .325 .066 5

28 1485A 1866 2015 150 6 1 .561 1.30 3.95 .875 .903 .335 2.65 .512 -.067 1

29 1485B 1902 2015 114 4 0 .612 1.11 2.99 .625 .771 .358 2.68 .482 .062 1

30 1489A 1940 2015 76 3 0 .574 1.25 4.29 .862 .770 .331 2.64 .416 -.037 1

31 1489B 1947 2015 69 3 0 .558 1.55 4.06 .953 .825 .291 2.72 .493 -.091 2

32 1490A 1942 2015 74 3 1 .600 2.18 4.32 .590 .631 .185 2.72 .460 .007 1

33 1490B 1920 2015 96 4 1 .558 2.14 4.77 .879 .804 .194 2.61 .482 -.027 1

34 1494A 1906 2015 110 4 1 .496 .82 2.41 .561 .815 .353 2.65 .487 .038 1

35 1494B 1910 2015 106 4 0 .583 .99 2.45 .583 .816 .375 2.49 .359 -.069 1

36 1495A 1932 2015 84 3 1 .582 1.73 4.03 1.023 .845 .247 2.34 .312 -.091 1

37 1495B 1927 2015 89 3 1 .512 1.44 3.58 .962 .811 .289 2.45 .328 -.043 1

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Total or mean: 3670 140 12 .561 1.15 5.46 .663 .760 .340 2.89 .428 -.011

- = [ COFECHA BEAL COF ] = -