[] Dendrochronology Program Library Run QUAL Program COF 09:50 Fri 04 Feb 2016 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 29622

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: QUAL\_CORE4WO\_Corr1-50

File of DATED series: QUAL\_CORE4WO\_Corr1

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 1846 to 2015 170 years

Continuous time span is 1846 to 2015 170 years

Portion with two or more series is 1882 to 2015 134 years

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

\*C\* Number of dated series 28 \*C\*

\*O\* Master series 1846 2015 170 yrs \*O\*

\*F\* Total rings in all series 3182 \*F\*

\*E\* Total dated rings checked 3146 \*E\*

\*C\* Series intercorrelation .642 \*C\*

\*H\* Average mean sensitivity .242 \*H\*

\*A\* Segments, possible problems 2 \*A\*

\*\*\* Mean length of series 113.6 \*\*\*

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

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

No ring measurements of zero value

1850 .298 1 1900 -.129 18 1950 .831 27 2000 .949 28

1851 .918 1 1901 .086 18 1951 2.210 27 2001 .016 28

1852 -.427 1 1902 1.892 18 1952 -.673 27 2002 1.242 28

1853 .267 1 1903 .542 18 1953 -.439 27 2003 -.754 28

1854 -1.032 1 1904 .532 18 1954 -.868 27 2004 1.056 28

1855 1.599 1 1905 -.128 20 1955 .535 27 2005 .205 28

1856 -1.693 1 1906 1.777 21 1956 -.529 27 2006 .629 28

1857 1.643 1 1907 .531 21 1957 -.382 27 2007 .690 28

1858 1.575 1 1908 -.049 21 1958 .460 27 2008 -.511 28

1859 -1.111 1 1909 -1.071 21 1959 -.174 27 2009 1.291 28

1860 1.411 1 1910 -1.453 21 1960 .740 27 2010 -.333 28

1861 -.594 1 1911 -1.166 21 1961 .831 27 2011 -.449 28

1862 .205 1 1912 -.675 21 1962 -1.305 27 2012 -.189 28

1863 -.026 1 1913 .575 21 1963 -1.926 27 2013 .560 28

1864 -2.720 1 1914 .756 21 1964 -2.123 27 2014 .227 28

1865 .128 1 1915 .632 21 1965 -1.811 27 2015 -1.618 28

1866 -2.893 1 1916 -.084 21 1966 -.342 27

1867 1.061 1 1917 -.031 21 1967 .420 27

1868 .168 1 1918 -.941 22 1968 .361 27

1869 .994 1 1919 -1.378 22 1969 1.055 27

1870 -1.392 1 1920 -1.164 22 1970 .733 27

1871 .833 1 1921 .415 22 1971 .803 28

1872 -.671 1 1922 -.242 22 1972 1.681 28

1873 -1.574 1 1923 .051 22 1973 .895 28

1874 1.630 1 1924 -.159 22 1974 1.051 28

1875 -.652 1 1925 .936 22 1975 .580 28

1876 -.540 1 1926 -.656 22 1976 .299 28

1877 -.157 1 1927 1.267 22 1977 .075 28

1878 -.038 1 1928 1.240 23 1978 .108 28

1879 1.591 1 1929 -.140 23 1979 -.178 28

1880 1.554 1 1930 -1.689 24 1980 .763 28

1881 2.836 1 1931 .073 24 1981 -1.541 28

1882 .945 2 1932 1.416 25 1982 -2.209 28

1883 .253 2 1933 -.759 27 1983 -1.331 28

1884 -.587 2 1934 .369 27 1984 -1.030 28

1885 -.595 4 1935 .558 27 1985 .373 28

1886 -.210 5 1936 -1.342 27 1986 .220 28

1887 -.937 6 1937 .913 27 1987 1.353 28

1888 -.821 7 1938 1.167 27 1988 .403 28

1889 .576 8 1939 .271 27 1989 1.637 28

1890 -.603 8 1940 .427 27 1990 .581 28

1891 .232 8 1941 -.658 27 1991 -1.367 28

1892 .125 10 1942 .227 27 1992 -.251 28

1893 .026 10 1943 -.534 27 1993 -.480 28

1894 .072 11 1944 .296 27 1994 -.509 28

1895 -.389 12 1945 1.134 27 1995 -.501 28

1846 1.162 1 1896 .523 13 1946 -.523 27 1996 -.069 28

1847 -1.357 1 1897 .295 15 1947 -.592 27 1997 -1.626 28

1848 1.131 1 1898 -1.088 18 1948 -.295 27 1998 -.011 28

1849 -1.653 1 1899 -.866 18 1949 -1.405 27 1999 -.582 28

PART 5: CORRELATION OF SERIES BY SEGMENTS: QUAL\_CORE4WO\_Corr1-50 09:50 Fri 04 Feb 2016 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 1875 1900 1925 1950 1975

1924 1949 1974 1999 2024

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

1 1517A 1905 2015 .41 .57 .67 .67

2 1517B 1898 2015 .62 .65 .69 .73 .68

3 1524A 1897 2015 .79 .78 .82 .85 .85

4 1524B 1882 2015 .64 .74 .82 .85 .85

5 1522A 1885 2015 .69 .77 .73 .40B .33

6 1522B 1885 2015 .77 .81 .74 .63 .68

7 1527A 1930 2015 .79 .72 .70

8 1527B 1928 2015 .76 .79 .77

9 1516A 1897 2015 .61 .60 .70 .81 .74

10 1516B 1905 2015 .60 .74 .74 .61

11 1518A 1887 2015 .41 .50 .71 .78 .66

12 1518B 1846 2015 .40 .64 .71 .78 .69

13 1525A 1906 2015 .70 .75 .75 .78

14 1525B 1892 2015 .53 .54 .74 .87 .77

15 1515A 1886 2015 .48 .59 .60 .53 .31B

16 1515B 1888 2015 .51 .52 .68 .73 .34

17 1514A 1894 2015 .51 .52 .68 .74 .44

18 1514B 1898 2015 .38 .39 .53 .71 .55

19 1520A 1971 2015 .66

20 1520B 1932 2015 .73 .65 .58

21 1519A 1918 2015 .64 .75 .76 .63

22 1519B 1895 2015 .57 .58 .72 .72 .61

23 1526A 1933 2015 .84 .86 .80

24 1526B 1933 2015 .79 .80 .79

25 1521A 1898 2015 .62 .63 .73 .74 .60

26 1521B 1896 2015 .69 .68 .68 .59 .68

27 1523A 1889 2015 .67 .69 .76 .74 .60

28 1523B 1892 2015 .73 .76 .78 .59 .36

Av segment correlation .59 .63 .72 .72 .63

PART 6: POTENTIAL PROBLEMS: QUAL\_CORE4WO\_Corr1-50 09:50 Fri 04 Feb 2016 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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1517A 1905 to 2015 111 years Series 1

[B] Entire series, effect on correlation ( .555) is:

Lower 1916< -.044 1930> -.042 1983> -.013 1954> -.010 1956> -.009 2011> -.008 Higher 1952 .019 1991 .019

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

1916 -6.2 SD; 1930 +4.4 SD; 1954 +3.1 SD; 1983 +3.4 SD

1517A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 113 146 142 136 103

1910 117 120 124 180 139 109 69 119 99 106

1920 103 141 152 141 131 144 129 177 142 114

1930 183 196 206 134 168 119 109 155 161 99

1940 104 83 119 119 113 138 84 100 118 87

1950 96 111 43 125 140 130 141 127 149 94

1960 105 107 47 30 38 32 81 84 91 148

1970 156 166 200 156 152 128 109 67 109 118

1980 102 50 48 166 168 190 131 202 174 132

1990 125 49 107 103 147 139 146 87 110 95

2000 141 136 178 134 173 133 129 114 80 150

2010 100 131 117 106 129 97

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1517B 1898 to 2015 118 years Series 2

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

Lower 2014< -.027 1989< -.008 1926> -.008 1951< -.008 1930> -.007 1954> -.007 Higher 1952 .013 1991 .013

1517B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1898 132 141

1900 128 150 149 116 137 85 123 88 113 81

1910 71 73 73 163 144 134 74 111 101 95

1920 67 117 112 105 105 106 112 134 152 108

1930 100 122 114 68 117 114 87 149 124 104

1940 78 57 49 52 72 81 41 50 31 33

1950 56 55 25 49 50 79 60 73 69 41

1960 44 69 28 31 25 28 53 48 58 73

1970 67 75 75 61 55 62 56 45 56 54

1980 81 44 35 51 85 151 169 174 129 100

1990 109 42 103 95 119 104 123 87 129 91

2000 135 91 129 71 120 82 96 98 83 122

2010 79 76 82 77 63 65

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1524A 1897 to 2015 119 years Series 3

[B] Entire series, effect on correlation ( .822) is:

Lower 2012< -.009 1941> -.008 1936> -.006 1952> -.006 1947< -.005 1908> -.005 Higher 1930 .007 1962 .007

1524A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1897 121 77 98

1900 129 119 228 189 173 164 254 176 209 107

1910 108 73 85 144 181 163 122 124 111 73

1920 60 119 81 103 103 120 72 143 154 114

1930 61 90 137 94 118 101 85 111 118 85

1940 122 108 114 71 102 110 68 45 58 46

1950 62 87 50 55 31 55 40 38 63 50

1960 68 77 32 37 35 34 66 95 65 93

1970 90 84 120 92 96 83 91 77 76 63

1980 78 48 43 40 44 96 77 118 74 117

1990 63 43 74 66 53 76 65 45 73 67

2000 81 69 89 67 99 77 94 86 72 111

2010 76 78 61 88 90 62

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1524B 1882 to 2015 134 years Series 4

[B] Entire series, effect on correlation ( .763) is:

Lower 1898< -.016 1931< -.008 1937< -.008 1946> -.007 1884< -.006 1911> -.006 Higher 1982 .010 2015 .009

1524B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1882 135 116 54 73 67 65 60 123

1890 109 107 97 108 133 111 176 145 70 95

1900 130 117 204 145 123 149 157 137 125 79

1910 71 112 106 138 125 128 123 97 88 75

1920 70 94 60 74 77 111 76 133 157 98

1930 60 55 117 64 97 117 61 74 111 103

1940 117 78 108 81 87 118 91 58 70 53

1950 69 98 49 51 29 60 48 44 74 50

1960 71 73 50 32 27 46 68 82 80 139

1970 108 125 173 129 123 103 106 110 91 77

1980 84 62 35 47 47 89 59 103 71 108

1990 70 55 79 62 66 60 60 48 65 59

2000 83 73 96 52 88 80 84 74 64 81

2010 67 66 66 79 63 49

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1522A 1885 to 2015 131 years Series 5

[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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1950 1999 -1 -.05 -.19 -.23 .17 -.12 -.10 -.07 .08 .16 .49\* .40| .09 -.14 -.04 -.30 -.03 -.18 .05 -.09 .10 .09

[B] Entire series, effect on correlation ( .516) is:

Lower 1998< -.077 1962> -.021 2000< -.015 1955< -.013 1997> -.011 1887> -.009 Higher 1930 .022 2015 .019

1950 to 1999 segment:

Lower 1998< -.169 1962> -.042 1955< -.026 1997> -.020 1999> -.014 1975< -.010 Higher 1951 .043 1964 .041

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

1997 1998 -4.5 SD 1998 1999 4.0 SD

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

1998 -6.1 SD; 2012 +3.9 SD

1522A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1885 51 52 66 53 67

1890 70 102 86 98 114 91 132 93 81 86

1900 94 99 170 139 84 93 139 116 100 75

1910 65 91 67 74 129 126 103 99 82 62

1920 92 106 91 123 102 161 96 144 133 105

1930 58 90 140 92 105 107 63 77 78 77

1940 84 69 67 65 71 89 61 60 46 38

1950 62 84 49 32 31 28 35 40 46 33

1960 54 40 45 32 23 30 38 45 47 53

1970 47 50 65 49 52 38 43 50 48 39

1980 62 38 31 35 25 33 33 55 37 50

1990 44 34 29 38 32 28 37 34 20 37

2000 28 29 32 31 37 37 30 36 30 31

2010 29 31 39 30 27 21

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1522B 1885 to 2015 131 years Series 6

[B] Entire series, effect on correlation ( .703) is:

Lower 1964< -.013 1937< -.010 1985< -.008 1886< -.007 1965> -.007 1955< -.007 Higher 1930 .013 2015 .011

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

1897 +3.0 SD

1522B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1885 48 49 55 65 85

1890 67 85 85 90 82 100 122 164 97 103

1900 128 140 226 136 131 124 155 131 104 94

1910 78 89 87 122 117 105 82 102 86 89

1920 90 104 93 94 104 115 93 131 132 111

1930 61 94 120 92 123 125 71 75 102 77

1940 94 86 96 65 95 115 49 42 62 39

1950 60 98 44 38 31 33 33 35 39 32

1960 37 44 33 32 18 37 34 44 45 57

1970 54 56 75 61 72 53 52 55 53 45

1980 56 40 31 27 29 31 29 42 37 62

1990 35 35 41 41 46 35 42 35 39 39

2000 47 38 38 36 50 35 39 39 36 44

2010 29 30 38 33 34 19

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1527A 1930 to 2015 86 years Series 7

[B] Entire series, effect on correlation ( .732) is:

Lower 1980< -.015 1985< -.013 1962> -.012 1992< -.011 1934< -.009 1993> -.008 Higher 1951 .015 1952 .013

1527A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 79 162 298 115 98 132 104 150 204 138

1940 118 104 155 102 100 106 100 105 101 62

1950 121 183 70 39 29 56 47 45 64 58

1960 76 58 54 33 39 43 68 126 112 133

1970 131 115 161 123 107 77 76 88 70 56

1980 39 32 25 25 32 24 39 55 51 63

1990 50 28 19 43 31 28 31 32 40 39

2000 73 61 79 58 69 58 71 62 63 115

2010 69 54 50 58 60 35

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1527B 1928 to 2015 88 years Series 8

[B] Entire series, effect on correlation ( .761) is:

Lower 1999< -.015 1936> -.012 1940< -.009 1985< -.008 1981> -.006 1933> -.006 Higher 1982 .013 1951 .012

1527B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1928 163 106

1930 45 77 104 92 87 100 90 118 206 144

1940 94 76 82 85 93 89 66 70 68 50

1950 92 159 82 53 31 54 47 36 50 77

1960 120 112 56 41 43 45 93 158 133 160

1970 193 153 197 139 150 116 105 127 89 63

1980 61 48 21 21 29 31 36 56 45 55

1990 54 35 37 43 44 38 42 38 42 33

2000 58 54 73 57 90 80 69 71 61 117

2010 70 63 56 51 54 38

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1516A 1897 to 2015 119 years Series 9

[B] Entire series, effect on correlation ( .714) is:

Lower 1930> -.022 2014< -.014 1936> -.012 1911> -.011 1904< -.010 1926> -.008 Higher 1962 .011 1981 .011

1516A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1897 118 82 84

1900 114 114 184 139 100 98 231 173 162 123

1910 112 178 205 228 233 221 154 134 101 92

1920 102 146 170 185 176 236 223 265 241 190

1930 216 267 298 196 235 225 226 298 286 248

1940 287 224 265 188 236 208 157 138 184 134

1950 196 228 129 129 151 195 141 162 156 154

1960 140 174 74 41 58 52 88 117 109 141

1970 170 156 148 159 158 154 128 128 122 137

1980 145 70 46 58 102 119 116 124 137 127

1990 114 54 65 61 63 79 74 69 110 129

2000 128 152 176 134 163 138 125 136 99 132

2010 117 109 98 112 95 89

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1516B 1905 to 2015 111 years Series 10

[B] Entire series, effect on correlation ( .635) is:

Lower 1930> -.017 2011< -.017 1914< -.015 2010> -.014 1920> -.012 1954> -.009 Higher 1962 .016 1981 .015

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

1914 -4.8 SD

1516B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 120 215 166 155 137

1910 108 87 63 65 55 101 86 83 107 80

1920 135 153 160 172 185 234 168 222 246 162

1930 184 247 292 170 236 263 199 274 241 224

1940 230 175 155 123 157 141 104 66 94 67

1950 127 167 95 102 122 119 109 110 119 117

1960 104 124 53 40 36 47 79 90 88 105

1970 104 127 122 130 119 138 103 107 91 110

1980 92 42 44 43 51 67 83 80 91 88

1990 80 30 48 49 54 61 54 40 49 75

2000 90 90 98 70 82 75 62 69 56 74

2010 82 63 67 70 73 70

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1518A 1887 to 2015 129 years Series 11

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

Lower 1919> -.020 1896< -.019 2008< -.013 2015> -.012 1930> -.012 1936> -.011 Higher 1952 .014 1962 .013

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

1919 +3.9 SD

1518A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1887 128 144 181

1890 151 145 131 108 163 126 98 122 135 94

1900 126 102 178 159 239 159 281 201 186 153

1910 139 109 131 170 206 191 136 131 107 180

1920 109 105 83 106 116 180 128 148 174 126

1930 128 136 162 118 136 146 130 150 125 124

1940 115 106 112 131 110 109 101 86 110 91

1950 130 170 79 100 106 125 99 79 108 76

1960 93 101 44 53 54 61 80 85 99 102

1970 75 115 125 101 133 124 98 74 106 102

1980 126 66 64 72 106 102 94 128 122 132

1990 83 41 45 52 55 88 67 55 81 85

2000 134 69 121 56 68 65 84 90 38 72

2010 51 50 60 78 60 58

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1518B 1846 to 2015 170 years Series 12

[\*] Early part of series cannot be checked from 1846 to 1881 -- not matched by another series

[B] Entire series, effect on correlation ( .596) is:

Lower 1887< -.030 2015> -.013 1940< -.011 1884> -.009 1889< -.009 1954> -.009 Higher 1982 .015 1981 .014

1518B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1846 199 115 189 104

1850 153 170 127 143 108 180 90 174 167 96

1860 153 102 116 109 66 109 64 126 108 124

1870 82 121 94 81 143 96 98 106 108 147

1880 146 185 114 94 103 94 127 48 93 75

1890 69 82 112 117 76 77 71 76 73 59

1900 67 82 141 88 118 65 98 83 69 71

1910 56 51 70 87 90 89 71 98 55 78

1920 62 88 62 70 96 78 69 82 94 81

1930 73 90 117 80 85 76 68 91 79 77

1940 66 73 75 73 76 89 69 81 92 61

1950 99 113 72 78 90 89 66 82 80 57

1960 83 78 53 38 63 48 66 89 111 112

1970 95 103 109 118 121 94 94 94 98 109

1980 120 58 52 69 84 82 70 99 83 95

1990 68 50 55 46 62 68 58 48 79 83

2000 103 62 111 71 86 75 93 77 39 56

2010 52 40 66 63 65 57

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1525A 1906 to 2015 110 years Series 13

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

Lower 1997< -.015 1962> -.011 2012< -.010 1942> -.008 1950< -.007 1925< -.006 Higher 1982 .012 2015 .011

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

1942 +3.9 SD

1525A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 216 162 106 101

1910 98 73 82 101 108 110 121 110 80 83

1920 61 101 66 98 71 91 86 143 174 124

1930 112 116 151 98 131 145 87 171 156 107

1940 125 123 252 130 166 138 87 58 81 55

1950 66 101 52 58 37 56 49 51 73 68

1960 55 71 51 34 30 22 36 71 61 89

1970 91 94 113 103 123 99 107 93 96 100

1980 102 57 51 87 72 107 104 147 136 117

1990 113 70 100 99 85 100 104 63 108 89

2000 106 88 114 96 129 95 113 92 96 125

2010 92 95 73 95 86 67

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1525B 1892 to 2015 124 years Series 14

[B] Entire series, effect on correlation ( .671) is:

Lower 1902< -.024 1930> -.016 2006< -.014 1909> -.012 1905> -.011 2005< -.010 Higher 2015 .012 1962 .010

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

1905 +3.5 SD

1525B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1892 218 185 206 159 193 160 120 147

1900 162 217 153 166 172 227 184 158 110 150

1910 114 77 108 116 154 148 153 112 90 69

1920 89 108 97 108 90 118 111 157 171 116

1930 111 104 141 95 109 116 68 96 107 117

1940 92 86 92 81 90 106 88 66 58 51

1950 64 88 65 56 44 64 55 51 69 58

1960 64 74 41 35 40 40 58 83 85 82

1970 113 99 149 126 113 82 90 92 87 70

1980 82 59 50 51 60 85 108 129 88 117

1990 87 52 65 62 64 67 74 50 92 64

2000 93 71 87 53 79 44 38 72 44 56

2010 49 52 56 53 48 33

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1515A 1886 to 2015 130 years Series 15

[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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1966 2015 -2 -.03 -.40 -.08 -.16 -.14 .20 .13 .11 .48\* .19 .31| - - - - - - - - - -

[B] Entire series, effect on correlation ( .449) is:

Lower 2013< -.037 1936> -.017 2011> -.010 1886> -.010 1928< -.010 1997> -.010 Higher 1906 .014 1930 .013

1966 to 2015 segment:

Lower 2013< -.090 2011> -.028 1997> -.022 1969< -.018 2008> -.017 2004< -.017 Higher 1981 .032 1972 .025

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

1886 +3.5 SD; 1895 +3.1 SD; 2013 -4.9 SD

1515A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1886 177 159 135 146

1890 136 154 130 133 167 240 243 176 182 176

1900 240 297 260 228 248 225 332 240 230 183

1910 152 169 207 287 216 231 254 244 189 227

1920 187 289 219 244 233 231 144 201 171 163

1930 143 217 215 162 186 173 174 209 172 148

1940 111 94 129 107 117 134 79 98 84 67

1950 154 148 86 106 77 106 70 54 83 56

1960 51 83 55 44 41 37 51 47 49 49

1970 77 94 108 82 115 103 101 53 86 76

1980 99 51 42 42 43 73 36 70 83 70

1990 87 54 35 41 28 37 23 35 32 21

2000 46 32 41 31 29 23 46 45 41 45

2010 34 44 35 23 38 32

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1515B 1888 to 2015 128 years Series 16

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

Lower 2002< -.027 2015> -.024 2000< -.019 1903< -.015 1919> -.014 1926< -.014 Higher 1952 .015 1951 .014

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

1903 -4.5 SD; 1919 +3.5 SD; 1990 +3.2 SD; 2015 +3.8 SD

1515B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1888 127 140

1890 127 134 154 193 187 185 206 170 121 146

1900 180 138 170 110 183 177 271 177 140 149

1910 116 141 189 206 226 211 189 180 180 198

1920 132 190 179 171 162 199 106 150 130 116

1930 114 177 191 133 145 155 137 162 173 156

1940 131 102 107 119 114 137 83 94 102 85

1950 133 154 71 72 84 79 56 50 58 70

1960 93 88 46 41 44 40 51 55 58 96

1970 76 91 105 93 90 103 86 52 88 70

1980 105 44 40 40 38 63 37 64 53 64

1990 84 44 45 46 37 34 26 30 31 33

2000 27 38 28 32 39 44 36 42 37 49

2010 44 40 34 39 40 43

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1514A 1894 to 2015 122 years Series 17

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

Lower 2015> -.031 2014< -.024 1930> -.015 1938< -.010 1998< -.008 1949> -.007 Higher 1962 .019 1952 .018

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

1931 +3.6 SD; 2015 +3.8 SD

1514A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1894 149 149 190 210 166 132

1900 157 134 151 166 154 124 173 123 100 98

1910 102 102 108 145 144 151 90 94 90 113

1920 77 141 173 151 141 147 144 172 155 160

1930 153 207 209 153 144 149 111 160 132 126

1940 150 137 132 108 163 143 88 105 96 108

1950 118 190 75 96 98 127 92 74 77 79

1960 106 119 41 43 41 48 83 59 113 87

1970 90 99 97 84 96 113 76 49 66 81

1980 71 40 26 42 79 102 104 117 113 98

1990 65 47 79 55 33 40 36 35 34 57

2000 57 58 79 65 65 78 67 83 56 109

2010 76 90 81 97 67 103

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1514B 1898 to 2015 118 years Series 18

[B] Entire series, effect on correlation ( .514) is:

Lower 1926> -.022 1930> -.019 1905< -.016 2009< -.015 1898> -.014 1942< -.012 Higher 1962 .020 1952 .019

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

1926 +4.3 SD; 2012 +3.2 SD

1514B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1898 187 185

1900 167 160 196 158 176 108 165 112 109 82

1910 87 76 86 112 103 96 64 65 49 96

1920 75 133 112 202 237 293 308 230 197 151

1930 171 185 188 122 134 136 101 137 123 139

1940 124 118 97 101 123 122 109 123 94 101

1950 135 140 67 66 79 84 60 63 56 34

1960 79 69 33 35 40 39 47 41 75 79

1970 68 65 80 75 83 83 69 58 84 67

1980 67 38 43 38 63 59 97 95 77 98

1990 62 30 53 48 38 37 38 31 36 29

2000 55 42 68 59 50 39 55 63 48 45

2010 36 59 82 70 79 68

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1520A 1971 to 2015 45 years Series 19

[B] Entire series, effect on correlation ( .664) is:

Lower 2011< -.027 2012< -.016 1991> -.014 1979< -.014 1995< -.007 1976< -.006 Higher 1989 .016 1972 .015

1520A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1971 155 160 133 116 103 94 108 95 64

1980 170 59 63 56 52 115 102 121 65 136

1990 98 64 69 56 79 55 104 64 121 68

2000 117 99 104 69 102 110 130 105 91 117

2010 90 77 83 113 95 86

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1520B 1932 to 2015 84 years Series 20

[B] Entire series, effect on correlation ( .647) is:

Lower 1988< -.021 1952> -.014 1982> -.014 1984> -.011 2015> -.010 1944< -.008 Higher 1981 .019 1963 .015

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

1998 +3.1 SD

1520B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 215 113 123 112 104 183 211 117

1940 166 88 139 84 80 138 98 129 98 37

1950 155 153 81 73 40 88 47 94 140 91

1960 165 117 64 38 54 50 92 189 113 120

1970 110 101 171 136 137 131 148 162 107 93

1980 196 64 113 124 162 205 166 142 55 166

1990 107 67 85 77 98 57 178 88 241 105

2000 200 178 143 80 143 119 148 145 131 227

2010 112 103 106 162 164 127

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1519A 1918 to 2015 98 years Series 21

[B] Entire series, effect on correlation ( .606) is:

Lower 2015< -.052 1920> -.036 2009< -.018 1947> -.010 1958< -.008 1931< -.006 Higher 1930 .017 1951 .013

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

1920 +4.9 SD; 2015 -9.1 SD

1519A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1918 135 111

1920 208 141 140 136 129 159 105 139 128 100

1930 68 86 105 91 136 126 86 130 131 104

1940 120 76 86 77 84 106 101 134 115 81

1950 115 153 79 74 53 103 53 57 57 71

1960 92 95 68 65 56 70 101 160 127 171

1970 140 114 148 116 115 109 92 99 94 72

1980 100 68 56 66 67 83 108 92 73 106

1990 67 55 72 49 57 46 67 57 85 53

2000 74 75 85 46 75 68 73 67 64 57

2010 60 61 59 64 59 52

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1519B 1895 to 2015 121 years Series 22

[B] Entire series, effect on correlation ( .623) is:

Lower 1920> -.025 2009< -.023 1944< -.011 2011> -.010 1925< -.009 1983> -.009 Higher 1930 .016 2015 .014

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

1920 +5.0 SD; 1983 +3.2 SD

1519B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1895 105 139 139 117 110

1900 130 107 293 262 244 286 363 255 197 129

1910 117 97 78 163 173 137 161 160 135 90

1920 191 126 106 76 68 83 56 109 113 100

1930 49 97 152 97 113 132 93 141 174 141

1940 164 109 109 113 81 149 110 116 118 61

1950 139 153 84 71 63 106 56 62 59 56

1960 78 68 47 54 42 40 57 96 95 114

1970 71 86 92 92 88 83 75 75 67 75

1980 104 58 53 77 47 64 70 69 49 81

1990 69 54 70 53 54 54 64 41 63 47

2000 61 49 67 49 59 52 58 58 60 49

2010 57 64 64 60 63 44

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1526A 1933 to 2015 83 years Series 23

[B] Entire series, effect on correlation ( .811) is:

Lower 2015> -.015 1954> -.009 1947< -.007 1983> -.007 2008> -.006 2011< -.005 Higher 1991 .009 1981 .009

1526A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 129 161 219 112 213 201 166

1940 156 111 126 113 131 138 114 81 118 89

1950 163 199 85 121 128 207 113 119 165 138

1960 110 115 63 44 49 56 90 122 90 137

1970 124 106 121 124 113 104 101 92 98 90

1980 115 57 41 79 56 102 73 129 93 124

1990 84 59 86 71 75 81 89 57 100 77

2000 99 74 106 83 104 107 128 106 105 120

2010 94 89 92 105 106 103

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1526B 1933 to 2015 83 years Series 24

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

Lower 1965> -.011 1954> -.010 2011> -.009 1946> -.007 2001< -.006 1975< -.006 Higher 1982 .011 1962 .011

1526B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 216 271 333 160 226 264 227

1940 193 150 186 131 157 201 169 109 145 107

1950 149 209 89 119 157 205 155 143 191 193

1960 153 154 69 69 70 125 189 211 155 207

1970 166 138 176 130 141 107 110 124 108 118

1980 99 74 50 77 86 103 111 119 115 115

1990 80 51 71 77 62 60 64 47 78 53

2000 70 53 86 59 90 74 81 79 73 91

2010 80 83 79 88 80 71

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1521A 1898 to 2015 118 years Series 25

[B] Entire series, effect on correlation ( .622) is:

Lower 2011< -.024 1919< -.020 1991> -.012 1928< -.011 2008> -.010 2015> -.009 Higher 1930 .019 1951 .014

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

1919 -7.5 SD

1521A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1898 77 83

1900 122 103 252 159 100 99 153 110 72 46

1910 53 74 94 67 71 58 62 44 41 25

1920 45 55 58 56 60 76 54 79 60 59

1930 40 61 86 81 95 93 83 114 129 97

1940 106 71 86 64 79 114 78 99 74 55

1950 75 113 66 55 56 64 51 42 53 50

1960 64 48 45 33 39 37 26 54 64 95

1970 127 116 168 129 108 94 94 83 60 47

1980 69 46 24 53 35 58 78 102 74 120

1990 78 68 51 59 69 65 75 50 64 61

2000 81 54 72 48 75 65 94 78 81 91

2010 74 51 72 75 69 68

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1521B 1896 to 2015 120 years Series 26

[B] Entire series, effect on correlation ( .639) is:

Lower 1952> -.025 1962> -.013 1919< -.012 1955< -.012 1911> -.011 2001< -.009 Higher 1930 .015 1936 .013

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

1966 +3.5 SD

1521B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1896 137 157 103 108

1900 138 162 257 114 119 85 165 138 106 72

1910 77 120 126 95 101 82 104 100 83 59

1920 84 91 110 96 96 128 98 136 126 94

1930 67 78 106 83 104 87 60 99 102 80

1940 91 69 75 75 68 83 58 72 55 46

1950 66 82 68 49 36 30 26 34 37 35

1960 72 54 54 43 31 34 122 118 96 93

1970 78 77 105 83 84 80 61 58 46 42

1980 58 46 48 47 47 65 61 77 56 81

1990 69 52 55 39 56 53 68 43 60 58

2000 92 50 76 55 70 74 73 62 61 71

2010 49 51 55 65 58 49

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1523A 1889 to 2015 127 years Series 27

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

Lower 2006< -.011 1995> -.010 1994< -.009 2014> -.009 1916> -.009 2000< -.008 Higher 1951 .012 1936 .012

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

2014 +3.4 SD

1523A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1889 229

1890 145 188 137 128 84 111 132 127 113 142

1900 115 282 386 221 193 167 203 128 132 79

1910 75 54 62 95 108 100 131 98 77 63

1920 60 86 86 80 57 70 70 91 108 84

1930 29 49 66 62 79 74 38 85 105 63

1940 93 62 88 65 89 95 78 54 51 52

1950 58 112 63 52 34 53 44 44 58 61

1960 70 72 42 38 39 46 70 66 71 85

1970 94 96 127 97 111 105 94 99 75 78

1980 103 56 43 49 38 61 67 66 46 73

1990 62 51 52 49 35 56 44 37 41 49

2000 42 49 54 40 49 41 38 56 42 52

2010 46 47 47 52 69 54

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1523B 1892 to 2015 124 years Series 28

[B] Entire series, effect on correlation ( .594) is:

Lower 1986< -.030 2008> -.018 1981> -.016 2002< -.013 2001> -.008 1941> -.008 Higher 1930 .017 1936 .016

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

2001 +3.5 SD; 2008 +3.2 SD

1523B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1892 220 191 175 112 168 190 123 133

1900 106 107 320 269 134 160 260 177 140 91

1910 84 101 109 155 149 180 195 143 143 123

1920 141 179 142 138 124 185 130 199 224 176

1930 90 112 143 106 129 168 95 129 159 123

1940 144 152 162 112 141 149 87 80 72 68

1950 99 151 79 64 39 89 56 75 74 72

1960 97 93 51 55 44 49 65 70 78 78

1970 75 74 108 86 99 99 100 96 80 73

1980 63 58 37 21 29 47 24 30 28 49

1990 32 17 41 30 28 19 31 23 23 21

2000 29 44 28 21 28 40 36 28 44 38

2010 34 36 47 46 35 28

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PART 7: DESCRIPTIVE STATISTICS: QUAL\_CORE4WO\_Corr1-50 09:50 Fri 04 Feb 2016 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 ()

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1 1517A 1905 2015 111 4 0 .555 1.22 2.06 .369 .519 .251 2.64 .481 -.038 1

2 1517B 1898 2015 118 5 0 .660 .88 1.74 .355 .678 .260 2.74 .515 -.055 3

3 1524A 1897 2015 119 5 0 .822 .91 2.54 .405 .684 .281 2.70 .556 .032 1

4 1524B 1882 2015 134 5 0 .763 .88 2.04 .329 .613 .264 2.70 .473 .031 1

5 1522A 1885 2015 131 5 1 .516 .65 1.70 .341 .804 .224 2.59 .393 .018 1

6 1522B 1885 2015 131 5 0 .703 .70 2.26 .370 .825 .202 2.75 .390 .022 1

7 1527A 1930 2015 86 3 0 .732 .78 2.98 .472 .673 .279 2.91 .444 .065 1

8 1527B 1928 2015 88 3 0 .761 .79 2.06 .424 .751 .262 2.94 .457 .062 1

9 1516A 1897 2015 119 5 0 .714 1.49 2.98 .596 .801 .198 2.70 .514 .041 1

10 1516B 1905 2015 111 4 0 .635 1.14 2.92 .595 .849 .208 2.52 .479 -.048 1

11 1518A 1887 2015 129 5 0 .600 1.12 2.81 .417 .664 .233 2.73 .462 .004 1

12 1518B 1846 2015 170 5 0 .596 .89 1.99 .303 .486 .244 2.78 .467 -.007 1

13 1525A 1906 2015 110 4 0 .730 .97 2.52 .362 .593 .246 2.73 .410 .010 2

14 1525B 1892 2015 124 5 0 .671 .96 2.27 .435 .827 .218 2.54 .388 -.016 1

15 1515A 1886 2015 130 5 1 .449 1.22 3.32 .779 .902 .240 2.66 .459 -.028 1

16 1515B 1888 2015 128 5 0 .512 1.05 2.71 .579 .871 .200 2.62 .401 -.055 1

17 1514A 1894 2015 122 5 0 .558 1.06 2.10 .427 .772 .218 2.82 .542 -.045 1

18 1514B 1898 2015 118 5 0 .514 .95 3.08 .547 .883 .218 2.59 .458 -.071 1

19 1520A 1971 2015 45 1 0 .664 .96 1.70 .293 .129 .300 2.76 .656 .066 1

20 1520B 1932 2015 84 3 0 .647 1.22 2.41 .461 .142 .397 2.75 .601 .029 1

21 1519A 1918 2015 98 4 0 .606 .92 2.08 .329 .642 .225 2.46 .303 .012 1

22 1519B 1895 2015 121 5 0 .623 .99 3.63 .564 .787 .245 2.60 .459 -.029 1

23 1526A 1933 2015 83 3 0 .811 1.09 2.19 .371 .509 .256 2.60 .481 .083 2

24 1526B 1933 2015 83 3 0 .791 1.25 3.33 .589 .763 .233 2.51 .539 .012 1

25 1521A 1898 2015 118 5 0 .622 .75 2.52 .317 .628 .263 2.69 .424 -.012 1

26 1521B 1896 2015 120 5 0 .639 .79 2.57 .339 .679 .223 2.80 .466 .007 1

27 1523A 1889 2015 127 5 0 .672 .82 3.86 .506 .785 .237 2.68 .386 .009 1

28 1523B 1892 2015 124 5 0 .594 .98 3.20 .606 .798 .258 2.79 .606 -.010 2

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Total or mean: 3182 122 2 .642 .97 3.86 .447 .700 .242 2.94 .466 -.001

- = [ COFECHA QUAL COF ] = -