[] Dendrochronology Program Library Run OWR Program COF 17:19 Tue 02 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 30319

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: owr.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 N

8 Parts printed 1234567

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

Time span of Master dating series is 1854 to 2016 163 years

Continuous time span is 1854 to 2016 163 years

Portion with two or more series is 1899 to 2016 118 years

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

\*C\* Number of dated series 12 \*C\*

\*O\* Master series 1854 2016 163 yrs \*O\*

\*F\* Total rings in all series 1193 \*F\*

\*E\* Total dated rings checked 1148 \*E\*

\*C\* Series intercorrelation .568 \*C\*

\*H\* Average mean sensitivity .161 \*H\*

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

\*\*\* Mean length of series 99.4 \*\*\*

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

No ring measurements of zero value

PART 2: TIME PLOT OF TREE-RING SERIES: 17:19 Tue 02 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

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

. . . . . . . . . . . . . . . . . . <========> . OWR05A 1 1924 2016 93

. . . . . . . . . . . . . . . . . <==========> . OWR05B 2 1907 2016 110

. . . . . . . . . . . . . . . . . . <=======> . OWR06A 3 1931 2016 86

. . . . . . . . . . . . . . . . . <==========> . OWR06B 4 1903 2016 114

. . . . . . . . . . . . . . . . . <===========> . OWR07A 5 1899 2016 118

. . . . . . . . . . . . . . . . <===============> . OWR07B 6 1854 2016 163

. . . . . . . . . . . . . . . . . . <=======> . OWR08A 7 1938 2016 79

. . . . . . . . . . . . . . . . . . <========> . OWR08B 8 1923 2016 94

. . . . . . . . . . . . . . . . . . <=====> . OWR09A 9 1953 2016 64

. . . . . . . . . . . . . . . . . . <=======> . OWR09B 10 1935 2016 82

. . . . . . . . . . . . . . . . . . <========> . OWR10A 11 1925 2016 92

. . . . . . . . . . . . . . . . . .<=========> . OWR10B 12 1919 2016 98

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

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: 17:19 Tue 02 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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1900 .741 2 1950 1.140 11 2000 .488 12

1901 -.998 2 1951 .795 11 2001 .999 12

1902 -1.667 2 1952 .166 11 2002 .444 12

1903 -.535 3 1953 -1.081 12 2003 -.897 12

1854 .761 1 1904 .762 3 1954 -.659 12 2004 -.501 12

1855 2.114 1 1905 .660 3 1955 -.512 12 2005 1.683 12

1856 .623 1 1906 -.288 3 1956 .343 12 2006 .025 12

1857 -1.302 1 1907 -.542 4 1957 -.004 12 2007 .055 12

1858 -.679 1 1908 -.313 4 1958 .874 12 2008 -.527 12

1859 -1.663 1 1909 -.467 4 1959 .200 12 2009 .873 12

1860 -1.516 1 1910 -.495 4 1960 -.910 12 2010 -.590 12

1861 -.149 1 1911 -1.527 4 1961 1.285 12 2011 -.669 12

1862 -.105 1 1912 -1.161 4 1962 1.287 12 2012 .236 12

1863 .489 1 1913 -1.002 4 1963 -.391 12 2013 -2.238 12

1864 -.283 1 1914 -2.228 4 1964 -.670 12 2014 .446 12

1865 1.420 1 1915 -.927 4 1965 .164 12 2015 .703 12

1866 -.355 1 1916 1.000 4 1966 .101 12 2016 .812 12

1867 -.529 1 1917 1.347 4 1967 -1.040 12

1868 -.993 1 1918 1.623 4 1968 -1.388 12

1869 -1.275 1 1919 .143 5 1969 .674 12

1870 -.918 1 1920 .419 5 1970 1.549 12

1871 -1.674 1 1921 1.060 5 1971 .489 12

1872 1.112 1 1922 .686 5 1972 -.768 12

1873 2.304 1 1923 1.240 6 1973 -.719 12

1874 2.107 1 1924 .484 7 1974 .175 12

1875 .903 1 1925 .529 8 1975 -.290 12

1876 .446 1 1926 -.646 8 1976 .587 12

1877 .876 1 1927 -.167 8 1977 -1.304 12

1878 .408 1 1928 .209 8 1978 -.887 12

1879 -.286 1 1929 1.191 8 1979 .851 12

1880 1.074 1 1930 .813 8 1980 -.059 12

1881 -.216 1 1931 .579 9 1981 .167 12

1882 .501 1 1932 -.394 9 1982 .219 12

1883 -.673 1 1933 -.071 9 1983 2.131 12

1884 -1.629 1 1934 -.970 9 1984 .617 12

1885 -1.823 1 1935 -2.330 10 1985 -1.267 12

1886 -2.897 1 1936 -.101 10 1986 -1.376 12

1887 -1.161 1 1937 -1.962 10 1987 1.288 12

1888 -1.200 1 1938 -.333 11 1988 .475 12

1889 -1.156 1 1939 .523 11 1989 -.699 12

1890 .724 1 1940 -1.199 11 1990 -.045 12

1891 .624 1 1941 -.477 11 1991 -.513 12

1892 .671 1 1942 -.133 11 1992 -.129 12

1893 1.221 1 1943 .472 11 1993 .504 12

1894 .593 1 1944 1.511 11 1994 -.430 12

1895 .772 1 1945 -.330 11 1995 -.975 12

1896 1.880 1 1946 .536 11 1996 .539 12

1897 1.352 1 1947 -.392 11 1997 .112 12

1898 1.028 1 1948 .862 11 1998 -1.336 12

1899 1.819 2 1949 -.168 11 1999 .476 12

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PART 4: Master Bar Plot: 17:19 Tue 02 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

1900--------C 1950---------E 2000------B

1901-d 1951--------C 2001---------D

1902g 1952-----A 2002------B

1903---b 1953-d 2003--d

1854--------C 1904--------C 1954--c 2004---b

1855----------H 1905--------C 1955---b 2005----------G

1856-------B 1906----a 1956------A 2006-----@

1857-e 1907---b 1957-----@ 2007-----@

1858--c 1908----a 1958--------C 2008---b

1859g 1909---b 1959-----A 2009--------C

1860f 1910---b 1960--d 2010---b

1861----a 1911f 1961---------E 2011--c

1862-----@ 1912-e 1962---------E 2012-----A

1863------B 1913-d 1963----b 2013i

1864----a 1914i 1964--c 2014------B

1865----------F 1915--d 1965-----A 2015--------C

1866----a 1916---------D 1966-----@ 2016--------C

1867---b 1917---------E 1967-d

1868-d 1918----------F 1968-f

1869-e 1919-----A 1969--------C

1870--d 1920------B 1970----------F

1871g 1921---------D 1971------B

1872---------D 1922--------C 1972--c

1873----------I 1923---------E 1973--c

1874----------H 1924------B 1974-----A

1875--------D 1925-------B 1975----a

1876------B 1926--c 1976-------B

1877--------D 1927----a 1977-e

1878------B 1928-----A 1978--d

1879----a 1929---------E 1979--------C

1880---------D 1930--------C 1980-----@

1881----a 1931-------B 1981-----A

1882-------B 1932---b 1982-----A

1883--c 1933-----@ 1983----------I

1884g 1934-d 1984-------B

1885g 1935i 1985-e

1886l 1936-----@ 1986-f

1887-e 1937h 1987---------E

1888-e 1938----a 1988------B

1889-e 1939-------B 1989--c

1890--------C 1940-e 1990-----@

1891-------B 1941---b 1991---b

1892--------C 1942----a 1992----a

1893---------E 1943------B 1993-------B

1894-------B 1944----------F 1994---b

1895--------C 1945----a 1995-d

1896----------H 1946-------B 1996-------B

1897---------E 1947----b 1997-----@

1898---------D 1948--------C 1998-e

1899----------G 1949----a 1999------B

PART 5: CORRELATION OF SERIES BY SEGMENTS: 17:19 Tue 02 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 1875 1900 1925 1950 1975

1924 1949 1974 1999 2024

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

1 OWR05A 1924 2016 .71 .77 .67 .69

2 OWR05B 1907 2016 .68 .64 .37 .22A

3 OWR06A 1931 2016 .41 .39 .55

4 OWR06B 1903 2016 .68 .55 .30B .57

5 OWR07A 1899 2016 .51 .49 .52 .48 .45

6 OWR07B 1854 2016 .67 .65 .54 .52 .61

7 OWR08A 1938 2016 .66 .54 .54

8 OWR08B 1923 2016 .77 .72 .56 .51

9 OWR09A 1953 2016 .44 .51

10 OWR09B 1935 2016 .54 .50 .63

11 OWR10A 1925 2016 .54 .54 .67

12 OWR10B 1919 2016 .52 .56 .67 .77

Av segment correlation .59 .64 .59 .50 .56

PART 6: POTENTIAL PROBLEMS: 17:19 Tue 02 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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OWR05A 1924 to 2016 93 years Series 1

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

Lower 1924< -.027 2016< -.019 1978< -.016 1965< -.011 2003< -.010 1932> -.009 Higher 2013 .055 1937 .032

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

OWR05B 1907 to 2016 110 years Series 2

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

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

1967 2016 0 .18 .08 -.04 -.14 .09 .21 -.08 .13 -.25 .15 .22\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .426) is:

Lower 1978< -.070 2013> -.051 2008> -.013 2016< -.012 1959< -.010 1913> -.010 Higher 1937 .067 1983 .016

1967 to 2016 segment:

Lower 1978< -.103 2013> -.069 2016< -.022 2008> -.021 1986> -.013 1989> -.012 Higher 1983 .046 1998 .021

[E] Outliers 5 3.0 SD above or -4.5 SD below mean for year

1913 +4.0 SD; 1914 +3.5 SD; 1978 -7.4 SD; 2008 +3.6 SD; 2013 +3.8 SD

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

OWR06A 1931 to 2016 86 years Series 3

[B] Entire series, effect on correlation ( .498) is:

Lower 2004< -.032 1969< -.024 2006> -.022 1953> -.018 2003> -.011 1955> -.010 Higher 2013 .083 1983 .020

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

1952 +3.3 SD; 1953 +3.8 SD; 1984 +3.5 SD; 2006 +4.0 SD

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OWR06B 1903 to 2016 114 years Series 4

[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 9 -.25 .29 .22 .05 -.37 -.05 .15 .12 .05 -.10 .30|-.02 -.31 -.12 .03 .01 .15 -.19 -.22 .32\* .12

[B] Entire series, effect on correlation ( .562) is:

Lower 1962< -.023 1982< -.018 2008< -.018 1997< -.014 1972> -.011 1953> -.010 Higher 2013 .050 1937 .044

1950 to 1999 segment:

Lower 1962< -.057 1982< -.044 1997< -.030 1972> -.026 1956< -.024 1953> -.023 Higher 1983 .056 1961 .040

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

1904 +3.2 SD; 1964 +4.0 SD; 1972 +3.2 SD

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OWR07A 1899 to 2016 118 years Series 5

[B] Entire series, effect on correlation ( .458) is:

Lower 2008> -.016 1939< -.015 2006< -.012 2009< -.012 1980< -.011 2002< -.010 Higher 2013 .035 1937 .022

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

1960 +3.5 SD; 2008 +4.3 SD

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OWR07B 1854 to 2016 163 years Series 6

[\*] Early part of series cannot be checked from 1854 to 1898 -- not matched by another series

[B] Entire series, effect on correlation ( .611) is:

Lower 1919> -.018 2002< -.013 1971< -.013 1968> -.011 1986> -.010 1973> -.009 Higher 2013 .036 1914 .014

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

1919 +3.4 SD; 1940 -4.9 SD; 1969 +3.4 SD

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OWR08A 1938 to 2016 79 years Series 7

[B] Entire series, effect on correlation ( .595) is:

Lower 1995< -.031 1978> -.017 1984< -.015 1998> -.013 1993< -.013 2003> -.012 Higher 1983 .024 1977 .017

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OWR08B 1923 to 2016 94 years Series 8

[B] Entire series, effect on correlation ( .626) is:

Lower 1973> -.019 2003> -.019 1978> -.017 1984< -.015 2013> -.015 1994< -.013 Higher 1937 .044 1935 .022

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

2003 +3.2 SD

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OWR09A 1953 to 2016 64 years Series 9

[B] Entire series, effect on correlation ( .508) is:

Lower 1999< -.048 1973< -.047 1988< -.015 2010> -.015 2006> -.011 2000< -.011 Higher 2013 .060 1983 .019

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OWR09B 1935 to 2016 82 years Series 10

[B] Entire series, effect on correlation ( .599) is:

Lower 1973< -.044 1951< -.022 1940> -.019 1948< -.012 1995> -.012 1957< -.009 Higher 2013 .048 1937 .025

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

1961 +3.3 SD; 1964 +3.0 SD; 2002 +3.4 SD

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OWR10A 1925 to 2016 92 years Series 11

[B] Entire series, effect on correlation ( .609) is:

Lower 1940> -.030 1937> -.019 1978> -.017 1998> -.016 1989< -.015 1973> -.009 Higher 2013 .077 1935 .020

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

1940 +3.2 SD; 1978 +3.3 SD; 2002 +3.3 SD

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OWR10B 1919 to 2016 98 years Series 12

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

Lower 1940> -.038 1919< -.020 1957< -.013 1937> -.013 1978> -.012 1930< -.006 Higher 2013 .070 1935 .011

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

1940 +4.2 SD

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PART 7: DESCRIPTIVE STATISTICS: 17:19 Tue 02 Jan 2018 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 OWR05A 1924 2016 93 4 0 .704 4.18 5.29 .720 .315 .168 2.61 .489 .024 3

2 OWR05B 1907 2016 110 4 1 .426 2.49 4.74 .844 .898 .124 2.45 .342 .006 3

3 OWR06A 1931 2016 86 3 0 .498 1.85 2.82 .319 .360 .148 2.56 .412 -.064 2

4 OWR06B 1903 2016 114 4 1 .562 2.77 7.73 1.435 .893 .156 2.71 .549 -.035 1

5 OWR07A 1899 2016 118 5 0 .458 2.84 5.12 .602 .696 .135 2.61 .443 -.019 2

6 OWR07B 1854 2016 163 5 0 .611 2.18 4.73 .887 .824 .202 2.71 .415 .019 1

7 OWR08A 1938 2016 79 3 0 .595 5.40 7.72 .977 .408 .152 2.92 .504 -.004 2

8 OWR08B 1923 2016 94 4 0 .626 4.00 8.48 1.163 .687 .181 2.75 .578 -.016 2

9 OWR09A 1953 2016 64 2 0 .508 3.58 7.02 1.160 .789 .164 2.53 .497 -.025 2

10 OWR09B 1935 2016 82 3 0 .599 3.42 5.30 .710 .392 .176 2.85 .501 .009 1

11 OWR10A 1925 2016 92 3 0 .609 3.82 5.22 .655 .409 .152 2.61 .453 -.008 1

12 OWR10B 1919 2016 98 4 0 .647 4.02 5.83 .871 .572 .157 2.64 .425 -.028 1

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Total or mean: 1193 44 2 .568 3.26 8.48 .864 .629 .161 2.92 .462 -.010

- = [ COFECHA OWR COF ] = -