[] Dendrochronology Program Library Run 168 Program COF 11:04 Wed 06 Apr 2011 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 27856

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 QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

 File of DATED series: 168\_HUB

 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 30 years lagged successively by 15 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 .4226

 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 1922 to 2010 89 years

 Continuous time span is 1922 to 2010 89 years

 Portion with two or more series is 1922 to 2010 89 years

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

 \*C\* Number of dated series 10 \*C\*

 \*O\* Master series 1922 2010 89 yrs \*O\*

 \*F\* Total rings in all series 745 \*F\*

 \*E\* Total dated rings checked 745 \*E\*

 \*C\* Series intercorrelation .581 \*C\*

 \*H\* Average mean sensitivity .249 \*H\*

 \*A\* Segments, possible problems 5 \*A\*

 \*\*\* Mean length of series 74.5 \*\*\*

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

 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: 11:04 Wed 06 Apr 2011 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

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

 . . . . . . . . . . . . . . . . . . <========> . 606A 1 1922 2010 89

 . . . . . . . . . . . . . . . . . . <=======> . 606B 2 1934 2010 77

 . . . . . . . . . . . . . . . . . . <=====> . 607A 3 1954 2010 57

 . . . . . . . . . . . . . . . . . . <======> . 607B 4 1944 2010 67

 . . . . . . . . . . . . . . . . . . <=======> . 608A 5 1936 2010 75

 . . . . . . . . . . . . . . . . . . <=======> . 608B 6 1935 2010 76

 . . . . . . . . . . . . . . . . . . <======> . 609A 7 1945 2010 66

 . . . . . . . . . . . . . . . . . . <======> . 609B 8 1944 2010 67

 . . . . . . . . . . . . . . . . . . <========> . 127A 9 1929 2010 82

 . . . . . . . . . . . . . . . . . . <========> . 127B 10 1922 2010 89

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

 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: 11:04 Wed 06 Apr 2011 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

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

 1950 -.703 9 2000 -.965 10

 1951 .393 9 2001 -.592 10

 1952 -.446 9 2002 .335 10

 1953 -2.053 9 2003 -2.583 10

 1954 .192 10 2004 -1.649 10

 1955 -.465 10 2005 -1.390 10

 1956 -.192 10 2006 .467 10

 1957 .998 10 2007 .800 10

 1958 1.165 10 2008 .317 10

 1959 .329 10 2009 .864 10

 1960 .924 10 2010 1.243 10

 1961 1.701 10

 1962 -1.754 10

 1963 -.099 10

 1964 -.778 10

 1965 .271 10

 1966 -.815 10

 1967 .471 10

 1968 .826 10

 1969 1.100 10

 1970 .813 10

 1971 1.260 10

 1922 1.473 2 1972 .439 10

 1923 -1.595 2 1973 -.639 10

 1924 -.777 2 1974 .371 10

 1925 .141 2 1975 .090 10

 1926 -1.923 2 1976 1.954 10

 1927 -.386 2 1977 .529 10

 1928 -.298 2 1978 -1.141 10

 1929 .832 3 1979 -.002 10

 1930 .813 3 1980 .250 10

 1931 .319 3 1981 -2.323 10

 1932 1.021 3 1982 -2.127 10

 1933 -.886 3 1983 -1.678 10

 1934 -1.506 4 1984 -1.019 10

 1935 .686 5 1985 -.632 10

 1936 .267 6 1986 -.457 10

 1937 .194 6 1987 .265 10

 1938 1.983 6 1988 .000 10

 1939 -.047 6 1989 -.038 10

 1940 -.381 6 1990 .834 10

 1941 .606 6 1991 .874 10

 1942 -.503 6 1992 1.645 10

 1943 .442 6 1993 1.269 10

 1944 -.197 8 1994 .931 10

 1945 1.429 9 1995 .337 10

 1946 -.666 9 1996 .384 10

 1947 .055 9 1997 .523 10

 1948 -1.005 9 1998 .178 10

 1949 .090 9 1999 -.982 10

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PART 4: Master Bar Plot: 11:04 Wed 06 Apr 2011 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

 1950--c 2000-d

 1951------B 2001--b

 1952---b 2002------A

 1953h 2003j

 1954-----A 2004g

 1955---b 2005-f

 1956----a 2006-------B

 1957---------D 2007--------C

 1958---------E 2008------A

 1959------A 2009--------C

 1960---------D 2010---------E

 1961----------G

 1962g

 1963----@

 1964--c

 1965------A

 1966--c

 1967-------B

 1968--------C

 1969---------D

 1970--------C

 1971---------E

 1922----------F 1972-------B

 1923f 1973--c

 1924--c 1974------A

 1925-----A 1975-----@

 1926h 1976----------H

 1927---b 1977-------B

 1928---a 1978-e

 1929--------C 1979----@

 1930--------C 1980-----A

 1931------A 1981i

 1932---------D 1982i

 1933-d 1983g

 1934f 1984-d

 1935--------C 1985--c

 1936------A 1986---b

 1937-----A 1987------A

 1938----------H 1988----@

 1939----@ 1989----@

 1940---b 1990--------C

 1941-------B 1991--------C

 1942---b 1992----------G

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

 1944----a 1994---------D

 1945----------F 1995------A

 1946--c 1996------B

 1947----@ 1997-------B

 1948-d 1998-----A

 1949-----@ 1999-d

PART 5: CORRELATION OF SERIES BY SEGMENTS: 11:04 Wed 06 Apr 2011 Page 5

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 Correlations of 30-year dated segments, lagged 15 years

 Flags: A = correlation under .4226 but highest as dated; B = correlation higher at other than dated position

 Seq Series Time\_span 1920 1935 1950 1965 1980 1995

 1949 1964 1979 1994 2009 2024

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

 1 606A 1922 2010 .43 .56 .57 .42 .62 .66

 2 606B 1934 2010 .53 .53 .69 .38B .44 .46

 3 607A 1954 2010 .79 .49 .45 .45

 4 607B 1944 2010 .61 .72 .43 .52 .53

 5 608A 1936 2010 .60B .56 .73 .89 .89

 6 608B 1935 2010 .53 .51 .65 .87 .85

 7 609A 1945 2010 .48 .56 .73 .74 .73

 8 609B 1944 2010 .62 .65 .76 .79 .81

 9 127A 1929 2010 .53 .51 .35A .60 .35B .32B

 10 127B 1922 2010 .60 .76 .69 .59 .63 .62

 Av segment correlation .52 .58 .61 .58 .63 .63

PART 6: POTENTIAL PROBLEMS: 11:04 Wed 06 Apr 2011 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 30-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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 606A 1922 to 2010 89 years Series 1

 [B] Entire series, effect on correlation ( .527) is:

 Lower 1959< -.053 1931> -.032 1922< -.019 1939> -.012 1999> -.011 1924> -.009 Higher 2003 .047 1962 .044

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

 1931 +3.3 SD

 606A Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1922 181 149 177 188 158 201 216 248

 1930 227 312 253 170 133 163 143 146 172 190

 1940 205 279 194 278 200 196 113 131 76 116

 1950 95 170 148 50 97 73 78 90 113 59

 1960 86 113 72 101 106 131 116 117 119 130

 1970 178 179 126 125 128 169 163 167 121 134

 1980 87 52 69 68 78 77 60 63 78 94

 1990 149 198 158 221 144 126 121 213 213 214

 2000 198 152 190 112 142 174 226 224 204 270

 2010 288

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

 606B 1934 to 2010 77 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

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

 1965 1994 -4 .07 -.06 .17 .05 .42 .17 .42\* .25 .25 .04 .38|-.01 -.25 -.14 -.31 -.42 -.36 -.29 -.28 -.17 -.39

 [B] Entire series, effect on correlation ( .519) is:

 Lower 1936< -.043 1952> -.026 1987< -.025 1942> -.022 2004> -.017 1957< -.015 Higher 1962 .072 2003 .064

 1965 to 1994 segment:

 Lower 1987< -.125 1973> -.049 1988< -.025 1986< -.019 1989< -.016 1982> -.012 Higher 1976 .066 1971 .027

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

 1952 +3.5 SD

 606B Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1934 141 203 146 161 208 186

 1940 178 167 191 193 146 145 118 120 95 127

 1950 85 190 235 108 136 87 67 71 78 103

 1960 155 161 84 119 109 126 114 181 194 208

 1970 189 225 178 200 195 181 213 166 136 149

 1980 155 114 107 78 66 67 49 32 33 36

 1990 62 90 94 124 120 107 169 165 153 103

 2000 100 89 108 68 118 109 118 109 94 107

 2010 205

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

 607A 1954 to 2010 57 years Series 3

 [B] Entire series, effect on correlation ( .592) is:

 Lower 1991< -.051 1954< -.040 2000> -.038 2005< -.014 1985> -.011 1967< -.011 Higher 1962 .105 2003 .040

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

 2000 +3.2 SD

 607A Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1954 84 97 134 173 176 152

 1960 184 177 89 161 128 185 129 128 180 186

 1970 146 156 161 124 121 116 174 115 102 128

 1980 113 71 70 74 91 120 124 127 72 71

 1990 87 59 97 81 94 85 135 134 125 90

 2000 177 114 163 90 134 89 134 182 207 255

 2010 211

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

 607B 1944 to 2010 67 years Series 4

 [B] Entire series, effect on correlation ( .581) is:

 Lower 1944> -.030 1953> -.018 1991< -.015 1973< -.014 1984> -.012 1988< -.012 Higher 1962 .092 2003 .045

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

 1973 -4.6 SD

 607B Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1944 41 46 25 19 32 26

 1950 13 25 13 25 79 98 110 166 177 166

 1960 189 208 113 141 133 206 171 180 209 220

 1970 170 172 139 102 147 131 182 144 122 152

 1980 202 140 159 104 193 200 224 212 138 160

 1990 206 145 202 181 191 139 190 178 146 92

 2000 137 126 169 100 185 134 228 206 278 307

 2010 306

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

 608A 1936 to 2010 75 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

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

 1936 1965 9 -.16 .00 -.12 .13 .18 .02 -.03 .01 .14 -.21 .60|-.24 -.11 .00 -.13 -.19 .02 .22 -.29 .66\*-.04

 [B] Entire series, effect on correlation ( .706) is:

 Lower 1962> -.068 1936> -.013 1975> -.009 1970< -.009 1951> -.009 1964> -.007 Higher 2003 .051 1953 .013

 1936 to 1965 segment:

 Lower 1962> -.138 1936> -.022 1964> -.012 1951> -.011 1954< -.008 1940> -.007 Higher 1953 .068 1938 .021

 608A Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1936 132 118 139 96

 1940 113 107 98 110 89 141 89 120 92 108

 1950 77 177 115 61 100 73 91 151 141 154

 1960 203 201 167 191 180 197 146 165 188 161

 1970 137 158 147 110 151 174 176 148 89 91

 1980 117 56 60 49 45 53 58 98 104 114

 1990 134 152 167 140 133 124 119 158 139 120

 2000 122 123 180 73 91 138 230 256 251 305

 2010 324

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

 608B 1935 to 2010 76 years Series 6

 [B] Entire series, effect on correlation ( .636) is:

 Lower 1962> -.053 1978< -.028 1950< -.022 1943< -.018 1944> -.008 2005> -.006 Higher 2003 .054 1976 .012

 608B Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1935 136 130 156 168 97

 1940 98 115 94 73 104 150 77 86 77 88

 1950 44 63 82 62 100 117 113 157 185 147

 1960 157 183 148 173 126 159 124 173 173 152

 1970 150 152 156 144 139 125 164 143 86 104

 1980 119 96 93 84 85 91 107 125 120 113

 1990 142 136 196 170 145 134 130 137 151 105

 2000 111 134 182 95 125 196 291 326 286 381

 2010 341

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 609A 1945 to 2010 66 years Series 7

 [B] Entire series, effect on correlation ( .569) is:

 Lower 1953> -.069 1945< -.041 1950> -.030 1966> -.014 1958< -.009 2001> -.008 Higher 1962 .081 2003 .023

 609A Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1945 107 90 147 164 200

 1950 281 239 212 245 340 258 214 292 244 231

 1960 215 286 138 191 181 177 208 249 207 248

 1970 205 211 156 133 152 112 153 111 75 89

 1980 80 37 32 41 51 39 66 76 96 115

 1990 151 177 162 134 109 73 47 53 52 42

 2000 16 83 88 22 14 26 43 86 82 73

 2010 273

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 609B 1944 to 2010 67 years Series 8

 [B] Entire series, effect on correlation ( .721) is:

 Lower 1950> -.017 1962> -.016 1972< -.011 1951< -.010 1944< -.009 2001> -.007 Higher 2003 .054 1976 .012

 609B Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1944 84 170 119 139 125 206

 1950 229 179 142 142 299 252 270 298 312 248

 1960 245 272 207 210 190 230 177 268 238 244

 1970 220 232 156 162 204 141 223 133 72 96

 1980 90 60 53 48 54 76 84 135 104 89

 1990 88 96 115 89 101 101 56 45 37 37

 2000 32 117 195 23 14 34 116 227 234 267

 2010 472

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 127A 1929 to 2010 82 years Series 9

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

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

 1950 1979 0 .01 .03 -.36 -.08 -.12 -.18 -.19 .27 -.07 .23 .35\* .24 -.07 -.11 -.02 -.21 -.26 .05 -.06 .04 .28

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

 1980 2009 -1 -.43 -.09 -.11 -.35 -.15 -.20 .04 .09 -.08 .40\* .35| .33 - - - - - - - - -

 1981 2010 -1 -.43 -.12 -.12 -.22 -.17 -.20 .00 .08 -.06 .37\* .32| - - - - - - - - - -

 [B] Entire series, effect on correlation ( .366) is:

 Lower 2003> -.107 1965< -.042 1962> -.023 1931< -.020 2002< -.011 2010< -.009 Higher 1981 .066 1938 .021

 1950 to 1979 segment:

 Lower 1965< -.180 1962> -.036 1963< -.015 1959> -.014 1964> -.013 1956> -.009 Higher 1953 .079 1976 .044

 1980 to 2009 segment:

 Lower 2003> -.393 2002< -.030 1983> -.009 1997< -.008 1986< -.006 1999> -.004 Higher 1981 .249 1992 .033

 1981 to 2010 segment:

 Lower 2003> -.375 2002< -.027 2010< -.021 1983> -.009 1997< -.007 1986< -.005 Higher 1981 .262 1992 .034

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

 2002 2003 5.2 SD

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

 2003 +4.0 SD

 127A Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1929 155

 1930 184 137 159 125 141 220 206 150 239 176

 1940 115 182 121 179 129 254 183 195 128 175

 1950 187 181 123 110 179 185 277 346 382 349

 1960 278 303 228 181 218 119 155 178 185 216

 1970 223 189 173 118 117 129 155 111 94 94

 1980 113 37 36 68 74 79 61 92 129 116

 1990 149 151 187 161 157 137 105 86 81 92

 2000 47 83 59 235 87 117 294 303 258 236

 2010 186

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 127B 1922 to 2010 89 years Series 10

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

 Lower 1983> -.015 1922> -.011 1968< -.010 1924< -.009 1988> -.009 1967< -.007 Higher 1962 .030 1981 .026

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

 1923 +3.4 SD

 127B Ring measurements

 Annual values

 Date 0 1 2 3 4 5 6 7 8 9

 1922 389 230 180 202 148 152 141 164

 1930 141 125 148 119 106 113 118 110 163 97

 1940 71 80 57 74 72 171 106 103 82 83

 1950 73 74 57 53 122 122 141 160 161 158

 1960 147 206 105 97 93 98 81 73 65 66

 1970 72 78 79 60 54 39 64 37 29 29

 1980 21 7 4 22 16 12 15 29 54 40

 1990 33 64 79 75 75 100 76 59 63 60

 2000 25 94 117 62 96 158 341 419 296 300

 2010 283

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PART 7: DESCRIPTIVE STATISTICS: 11:04 Wed 06 Apr 2011 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 606A 1922 2010 89 6 0 .527 1.51 3.12 .601 .754 .227 2.53 .442 -.082 1

 2 606B 1934 2010 77 6 1 .519 1.31 2.35 .495 .721 .214 2.83 .591 -.135 1

 3 607A 1954 2010 57 4 0 .592 1.30 2.55 .425 .567 .243 2.60 .524 -.028 1

 4 607B 1944 2010 67 5 0 .581 1.47 3.07 .676 .797 .279 2.57 .439 -.097 1

 5 608A 1936 2010 75 5 1 .706 1.35 3.23 .543 .773 .219 2.60 .435 .050 2

 6 608B 1935 2010 76 5 0 .636 1.39 3.81 .606 .829 .196 2.61 .448 -.038 1

 7 609A 1945 2010 66 5 0 .569 1.39 3.40 .830 .828 .298 2.49 .342 -.079 1

 8 609B 1944 2010 67 5 0 .721 1.55 4.72 .899 .779 .291 2.63 .487 .039 1

 9 127A 1929 2010 82 6 3 .366 1.63 3.82 .728 .721 .268 2.53 .403 -.024 1

 10 127B 1922 2010 89 6 0 .626 1.07 4.19 .799 .849 .272 2.92 .516 .064 1

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

 Total or mean: 745 53 5 .581 1.40 4.72 .663 .766 .249 2.92 .463 -.032

 - = [ COFECHA 168 COF ] = -