[] Dendrochronology Program Library Run FAGR Program COF 13:48 Mon 28 Nov 2016 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 29919

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: FAGR\_LEMP13\_Corr3-50

File of DATED series: FAGR\_LEMP13\_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 1902 to 2015 114 years

Continuous time span is 1902 to 2015 114 years

Portion with two or more series is 1903 to 2015 113 years

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

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

\*O\* Master series 1902 2015 114 yrs \*O\*

\*F\* Total rings in all series 2813 \*F\*

\*E\* Total dated rings checked 2812 \*E\*

\*C\* Series intercorrelation .609 \*C\*

\*H\* Average mean sensitivity .260 \*H\*

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

\*\*\* Mean length of series 100.5 \*\*\*

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

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

136B 1 absent rings: 1925

1 absent rings .036%

1950 -2.098 28 2000 -.295 28

1951 .187 28 2001 .382 28

1902 -1.132 1 1952 .088 28 2002 -1.172 28

1903 1.619 3 1953 -.650 28 2003 -1.590 28

1904 1.771 4 1954 .924 28 2004 1.343 28

1905 1.013 6 1955 1.620 28 2005 -.064 28

1906 .464 9 1956 .341 28 2006 -.379 28

1907 .389 11 1957 -1.490 28 2007 -.122 28

1908 -.678 13 1958 -.117 28 2008 .380 28

1909 .042 14 1959 -.221 28 2009 1.730 28

1910 .744 14 1960 -.097 28 2010 .768 28

1911 -.185 16 1961 .453 28 2011 .698 28

1912 -.052 16 1962 -.328 28 2012 -.060 28

1913 .024 16 1963 1.056 28 2013 .201 28

1914 -.572 16 1964 .558 28 2014 .838 28

1915 -.067 16 1965 -.618 28 2015 -3.871 28

1916 .827 17 1966 -.348 28

1917 .352 17 1967 -.369 28

1918 .071 18 1968 1.752 28

1919 -.864 18 1969 .252 28

1920 .142 19 1970 .730 28

1921 -.639 19 1971 .087 28

1922 .000 20 1972 .755 28

1923 -.575 20 1973 .732 28

1924 -1.198 22 1974 .643 28

1925 -2.076 22 1 1975 -.525 28

1926 -1.466 24 1976 -.392 28

1927 -1.552 24 1977 -.234 28

1928 -.483 24 1978 .230 28

1929 .889 24 1979 .934 28

1930 .600 24 1980 -.686 28

1931 1.691 25 1981 -2.051 28

1932 1.547 25 1982 .604 28

1933 .710 25 1983 -.680 28

1934 .963 25 1984 .922 28

1935 .939 25 1985 .834 28

1936 .074 25 1986 .591 28

1937 .271 26 1987 .327 28

1938 .194 26 1988 -.318 28

1939 .086 26 1989 -2.485 28

1940 .146 26 1990 -2.677 28

1941 -.813 26 1991 -1.176 28

1942 .251 26 1992 .558 28

1943 -.243 27 1993 -.747 28

1944 .536 27 1994 .516 28

1945 .089 27 1995 1.069 28

1946 -1.012 27 1996 1.670 28

1947 .153 28 1997 .341 28

1948 -1.587 28 1998 .934 28

1949 -1.890 28 1999 .296 28

PART 5: CORRELATION OF SERIES BY SEGMENTS: FAGR\_LEMP13\_Corr3-50 13:48 Mon 28 Nov 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 1900 1925 1950 1975

1949 1974 1999 2024

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

1 123A 1909 2015 .51 .59 .55 .78

2 123B 1906 2015 .47 .63 .75 .74

3 124A 1907 2015 .64 .63 .70 .77

4 124B 1904 2015 .55 .46 .62 .77

5 130A 1906 2015 .50 .56 .32A .41

6 130B 1916 2015 .41 .48 .36 .32A

7 136A 1920 2015 .65 .65 .51 .69

8 136B 1905 2015 .38 .52 .63 .77

9 137A 1911 2015 .60 .58 .45 .48

10 137B 1924 2015 .42 .42 .41 .64

11 138A 1906 2015 .41 .60 .51 .57

12 138B 1922 2015 .62 .55 .51 .73

13 139A 1926 2015 .53 .59 .64

14 139B 1926 2015 .48 .53 .69

15 146A 1907 2015 .40 .35 .55 .81

16 146B 1908 2015 .48 .45 .63 .66

17 155A 1943 2015 .50 .56 .74

18 155B 1937 2015 .55 .70 .81

19 157A 1903 2015 .69 .54 .43 .59

20 157B 1902 2015 .46 .62 .70 .83

21 186A 1908 2015 .53 .62 .64 .74

22 186B 1918 2015 .55 .66 .53 .68

23 224A 1903 2015 .54 .69 .52 .56

24 224B 1905 2015 .53 .61 .59 .69

25 347A 1911 2015 .67 .67 .47 .49

26 347B 1924 2015 .65 .65 .53 .59

27 360A 1947 2015 .59 .58 .66

28 360B 1931 2015 .42 .55 .78

Av segment correlation .53 .56 .55 .66

PART 6: POTENTIAL PROBLEMS: FAGR\_LEMP13\_Corr3-50 13:48 Mon 28 Nov 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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123A 1909 to 2015 107 years Series 1

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

Lower 1955< -.019 1914> -.013 1966> -.012 1997> -.009 1984< -.009 1951< -.007 Higher 2015 .126 1981 .010

123A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 107

1910 97 58 74 76 86 87 71 65 43 34

1920 43 77 55 45 61 40 54 55 160 227

1930 147 187 147 107 127 104 77 67 68 79

1940 75 82 134 93 152 96 40 96 39 31

1950 34 36 45 36 85 52 47 36 49 47

1960 57 103 88 118 124 76 157 136 141 90

1970 107 132 116 113 146 123 151 134 185 222

1980 94 48 83 106 95 106 101 88 104 69

1990 68 85 126 111 259 204 261 270 288 216

2000 179 173 110 103 172 127 124 140 115 131

2010 113 117 89 82 109 39

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

123B 1906 to 2015 110 years Series 2

[B] Entire series, effect on correlation ( .634) is:

Lower 1942< -.026 1911< -.014 1906> -.009 1928> -.009 1941> -.008 1909< -.006 Higher 2009 .011 1968 .010

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

1981 -5.3 SD

123B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 269 207 157 121

1910 155 93 112 109 108 90 88 67 71 55

1920 70 89 78 53 79 55 48 53 171 183

1930 137 128 179 140 173 129 115 113 143 111

1940 85 104 57 77 113 102 62 100 51 34

1950 35 64 42 40 75 88 62 43 43 50

1960 57 78 81 101 72 62 57 43 92 70

1970 75 61 92 96 109 65 55 57 77 67

1980 49 21 68 74 84 104 87 100 105 68

1990 37 46 131 110 216 206 306 230 237 156

2000 163 159 85 65 112 74 105 122 142 224

2010 145 109 81 99 87 55

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124A 1907 to 2015 109 years Series 3

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

Lower 1983< -.027 1943> -.009 1951< -.009 1957> -.008 1997< -.008 1907> -.007 Higher 2015 .033 1989 .019

124A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1907 207 161 187

1910 163 129 113 96 55 64 76 77 84 46

1920 76 52 47 54 25 22 29 24 70 133

1930 139 227 203 255 244 223 133 184 136 165

1940 165 126 232 262 220 213 129 147 124 79

1950 94 98 120 109 146 164 129 128 155 152

1960 145 164 126 153 162 149 161 222 279 247

1970 266 224 223 189 182 146 191 179 175 200

1980 170 113 180 106 162 174 172 208 191 107

1990 101 145 163 123 172 209 261 156 186 191

2000 186 198 164 133 247 163 153 158 185 209

2010 190 233 179 192 154 60

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124B 1904 to 2015 112 years Series 4

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

Lower 1946< -.018 1943< -.014 1959< -.013 1948> -.012 1994< -.007 1995< -.007 Higher 2015 .068 1989 .023

124B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 216 124 129 106 83 88

1910 99 94 86 80 56 69 86 66 70 38

1920 61 50 36 42 35 14 20 26 85 219

1930 251 399 338 289 256 247 143 208 118 146

1940 179 158 181 54 75 96 20 53 64 43

1950 56 66 85 67 98 123 118 101 135 82

1960 89 128 101 153 178 166 219 224 267 204

1970 185 156 175 159 195 190 210 187 187 248

1980 175 137 205 134 194 214 211 171 186 103

1990 117 108 187 155 140 138 195 148 168 143

2000 128 162 153 153 299 227 234 257 202 245

2010 197 243 187 176 289 75

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130A 1906 to 2015 110 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

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

1950 1999 0 .01 .10 -.25 .22 -.28 -.07 -.06 .18 -.20 .16 .32\* .26 -.14 -.01 -.01 .09 -.30 .10 -.34 .19 -.03

[B] Entire series, effect on correlation ( .431) is:

Lower 1976< -.039 1996< -.020 1948> -.018 1975> -.017 1986< -.013 1997> -.010 Higher 2015 .067 1990 .021

1950 to 1999 segment:

Lower 1976< -.047 1996< -.037 1975> -.034 1997> -.020 1986< -.019 1983> -.018 Higher 1990 .063 1968 .042

130A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 53 36 28 39

1910 141 191 160 147 202 194 281 269 238 194

1920 260 222 198 192 159 144 127 170 212 269

1930 258 264 255 185 181 216 212 228 177 174

1940 165 162 184 160 178 148 147 176 199 167

1950 150 212 156 193 300 374 184 161 197 229

1960 157 183 188 201 158 164 144 150 244 158

1970 191 208 170 161 144 179 93 141 121 108

1980 95 102 139 132 105 150 88 102 92 90

1990 53 124 114 112 107 188 112 205 194 187

2000 96 91 112 142 257 233 146 121 163 238

2010 209 136 101 85 163 27

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130B 1916 to 2015 100 years Series 6

[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 .21 .19 -.39 .17 -.25 .06 -.14 .12 -.18 .18 .32\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .352) is:

Lower 1917< -.027 1989> -.025 1939< -.024 1981> -.018 1975> -.013 1948> -.010 Higher 1990 .028 2004 .017

1966 to 2015 segment:

Lower 1989> -.039 1981> -.028 1975> -.022 1976< -.016 1983> -.015 2003> -.011 Higher 1990 .046 2004 .031

130B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 234 159 178 203

1920 206 172 209 199 189 154 167 165 205 192

1930 212 244 196 172 154 171 162 165 162 102

1940 121 113 202 179 209 154 102 135 165 136

1950 133 288 252 207 224 273 155 158 223 223

1960 232 200 161 191 171 147 166 189 190 143

1970 165 198 173 263 219 225 119 144 126 146

1980 95 146 156 169 200 203 151 100 113 144

1990 62 96 116 94 99 221 162 179 180 178

2000 92 174 153 170 267 201 124 147 133 202

2010 129 78 43 40 45 21

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136A 1920 to 2015 96 years Series 7

[B] Entire series, effect on correlation ( .687) is:

Lower 1980< -.032 1981> -.022 1968< -.011 1976> -.008 1970< -.007 1992< -.006 Higher 2015 .095 2009 .009

136A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1920 57 30 25 21 53 21 24 26 36 183

1930 180 287 314 208 192 197 195 187 146 141

1940 112 115 116 95 106 95 56 52 29 11

1950 11 34 113 138 152 162 125 65 84 151

1960 197 211 172 200 192 123 124 86 107 125

1970 116 147 200 180 180 134 158 134 148 166

1980 100 106 113 88 105 118 136 155 117 87

1990 89 129 125 111 167 205 251 158 150 146

2000 119 148 76 67 109 106 134 156 168 262

2010 210 150 146 124 139 47

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136B 1905 to 2015 111 years Series 8

[B] Entire series, effect on correlation ( .651) is:

Lower 1907< -.036 1953> -.010 1916< -.009 1966< -.008 1955< -.006 1959> -.006 Higher 2015 .075 1989 .020

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

1925 -2.076 22 1

136B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 172 131 46 47 35

1910 47 36 64 64 30 34 20 16 9 10

1920 7 14 11 8 12 0 7 9 19 105

1930 196 324 260 136 130 168 163 158 143 112

1940 92 87 94 59 73 46 22 36 24 6

1950 14 25 57 92 128 109 80 50 71 132

1960 134 147 139 191 179 167 114 92 115 131

1970 130 126 144 146 192 176 177 181 170 195

1980 122 79 131 103 120 150 118 136 108 68

1990 56 83 119 116 118 172 158 148 134 138

2000 89 113 68 45 96 118 122 187 170 249

2010 197 183 146 118 144 54

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137A 1911 to 2015 105 years Series 9

[B] Entire series, effect on correlation ( .494) is:

Lower 1981> -.020 1987< -.017 2003> -.014 1990> -.012 1914> -.011 2002> -.011 Higher 2015 .054 1948 .017

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

2003 +3.3 SD

137A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1911 53 62 77 87 57 100 90 54 29

1920 43 19 26 9 8 13 21 13 30 28

1930 34 51 53 73 90 72 93 70 95 72

1940 60 38 72 100 91 88 49 74 11 23

1950 14 57 92 121 162 207 178 73 105 122

1960 136 160 160 149 140 150 168 191 234 201

1970 264 262 232 280 259 196 203 215 227 231

1980 171 181 181 187 192 188 162 106 105 76

1990 94 81 97 99 92 81 82 89 123 150

2000 152 235 215 249 209 84 60 65 95 155

2010 213 189 166 120 132 56

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137B 1924 to 2015 92 years Series 10

[B] Entire series, effect on correlation ( .589) is:

Lower 1994< -.032 1968< -.025 1981> -.022 1929< -.015 1987< -.014 1926> -.013 Higher 2015 .164 1957 .016

137B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 26 15 36 47 28 23

1930 29 45 48 69 89 74 76 56 82 41

1940 44 41 70 65 64 59 58 66 35 45

1950 33 86 115 126 175 241 194 63 77 143

1960 197 168 179 191 186 173 207 227 178 159

1970 168 152 225 242 194 179 196 142 155 200

1980 146 161 211 193 219 167 150 89 89 84

1990 110 124 121 124 83 140 227 159 173 147

2000 154 181 156 117 213 186 196 204 223 199

2010 159 153 143 156 144 63

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138A 1906 to 2015 110 years Series 11

[B] Entire series, effect on correlation ( .531) is:

Lower 1980> -.026 1981< -.017 1929< -.016 1997< -.016 2003> -.010 2002> -.010 Higher 2015 .075 1968 .012

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

1980 1981 -4.3 SD

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

1981 -4.8 SD

138A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 56 66 44 74

1910 60 78 132 160 127 106 108 54 45 65

1920 100 90 93 75 73 64 77 28 33 27

1930 124 272 292 207 176 167 219 174 158 156

1940 144 103 124 117 127 127 135 135 87 114

1950 108 330 312 307 290 301 159 120 154 196

1960 189 223 284 278 284 190 183 190 318 236

1970 230 235 268 282 249 210 278 242 245 236

1980 286 81 159 135 206 157 215 194 164 126

1990 111 169 228 234 227 212 322 150 200 160

2000 255 279 275 306 386 310 271 217 204 312

2010 276 245 206 264 299 57

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138B 1922 to 2015 94 years Series 12

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

Lower 1997< -.032 1989> -.023 1980> -.017 1974< -.012 1995< -.011 1983> -.009 Higher 2015 .122 1981 .010

138B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1922 64 33 16 11 8 7 34 48

1930 148 341 376 228 215 187 200 150 140 120

1940 130 97 96 97 110 115 140 134 81 96

1950 87 349 357 352 318 404 191 182 182 207

1960 224 238 275 324 278 199 206 156 272 189

1970 170 111 106 103 72 70 108 116 199 256

1980 246 126 198 222 293 255 290 248 252 222

1990 121 156 246 200 266 213 332 175 264 207

2000 221 223 163 185 283 257 245 240 192 275

2010 211 221 172 186 181 45

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139A 1926 to 2015 90 years Series 13

[B] Entire series, effect on correlation ( .621) is:

Lower 1974< -.040 1962> -.012 1990> -.011 1944< -.010 1941> -.009 1940< -.008 Higher 2015 .019 1981 .017

139A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 20 19 26 98

1930 119 185 174 118 155 166 81 123 99 100

1940 65 86 101 72 54 48 46 48 32 34

1950 36 64 63 34 55 70 42 42 52 51

1960 54 80 93 115 71 76 89 81 97 61

1970 86 66 83 78 53 58 68 68 90 87

1980 74 56 112 81 122 109 116 114 97 80

1990 93 62 122 87 104 120 236 179 178 131

2000 114 139 33 41 88 63 45 47 81 89

2010 50 106 107 127 150 30

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139B 1926 to 2015 90 years Series 14

[B] Entire series, effect on correlation ( .624) is:

Lower 2010< -.027 1957> -.020 1967< -.017 1943< -.017 1991< -.015 2000> -.011 Higher 2015 .082 1989 .027

139B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 36 28 23 86

1930 99 204 231 182 183 226 142 142 124 135

1940 117 132 150 74 99 73 70 61 40 49

1950 54 53 36 31 54 62 52 51 45 33

1960 42 61 45 81 79 74 65 44 66 74

1970 95 86 118 143 122 90 134 101 100 156

1980 112 81 139 99 140 193 173 135 116 56

1990 101 59 113 106 172 177 174 155 212 167

2000 264 267 166 139 352 211 233 208 217 249

2010 97 145 113 152 156 41

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146A 1907 to 2015 109 years Series 15

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

Lower 1957> -.029 1948> -.020 1941< -.013 1977< -.009 1914> -.008 1907> -.008 Higher 2015 .098 1989 .019

146A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1907 120 92 108

1910 103 84 97 90 116 122 159 168 143 133

1920 148 131 132 89 88 87 98 82 130 230

1930 238 279 238 163 192 165 173 213 176 170

1940 178 99 149 202 186 210 187 186 180 106

1950 132 126 112 77 108 149 123 157 188 126

1960 84 181 102 126 116 87 74 85 104 107

1970 102 134 143 120 143 113 132 79 116 139

1980 93 55 108 104 139 161 120 126 112 51

1990 30 62 111 104 102 109 135 138 150 145

2000 99 121 66 52 120 123 123 104 137 140

2010 115 116 93 110 125 50

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146B 1908 to 2015 108 years Series 16

[B] Entire series, effect on correlation ( .593) is:

Lower 1948> -.020 1957> -.014 1960< -.013 1946> -.009 1950> -.009 1991> -.006 Higher 1989 .026 1990 .013

146B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1908 118 123

1910 140 120 130 130 102 146 167 147 174 131

1920 134 132 121 118 81 100 123 128 169 291

1930 267 386 366 181 171 171 156 245 177 164

1940 193 106 124 123 191 202 196 190 186 136

1950 154 186 153 100 130 172 110 128 164 144

1960 81 167 94 113 130 98 78 91 191 151

1970 161 157 159 135 148 125 162 160 136 173

1980 139 67 122 109 145 140 123 153 124 66

1990 50 124 146 112 109 111 136 111 104 114

2000 107 115 61 40 85 85 103 104 137 149

2010 121 146 108 126 103 56

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155A 1943 to 2015 73 years Series 17

[B] Entire series, effect on correlation ( .646) is:

Lower 1953< -.050 1976< -.024 1981> -.017 1945> -.013 1975> -.010 1990> -.008 Higher 2015 .102 1989 .027

155A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 160 158 275 176 177 129 86

1950 100 149 106 62 99 104 99 79 104 92

1960 93 104 86 109 120 120 107 124 186 166

1970 208 137 153 122 187 162 66 87 111 184

1980 114 135 176 107 188 168 152 193 185 101

1990 153 153 206 146 282 248 231 198 217 235

2000 241 201 171 146 200 140 174 197 208 214

2010 158 191 163 161 199 59

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155B 1937 to 2015 79 years Series 18

[B] Entire series, effect on correlation ( .756) is:

Lower 1976< -.022 1981> -.020 1937< -.016 1948> -.015 1990> -.014 1952< -.010 Higher 2015 .099 1989 .013

155B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 60 91 96

1940 130 132 135 134 152 130 118 117 101 60

1950 52 103 66 49 80 96 89 66 92 85

1960 88 103 101 127 122 99 90 100 161 130

1970 185 132 170 158 162 140 79 91 122 138

1980 106 130 165 156 193 176 204 195 164 71

1990 140 192 260 207 301 306 311 189 231 233

2000 188 210 144 160 276 245 242 244 240 294

2010 258 239 222 209 199 52

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157A 1903 to 2015 113 years Series 19

[B] Entire series, effect on correlation ( .580) is:

Lower 1973< -.036 1962< -.031 1993< -.015 1980> -.009 1981> -.006 1956> -.006 Higher 2015 .019 1948 .013

157A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 237 204 221 206 161 119 99

1910 106 85 80 64 48 45 58 53 56 37

1920 58 43 49 50 35 38 62 55 76 129

1930 87 91 117 82 97 93 65 82 77 86

1940 87 62 96 52 71 70 60 74 31 42

1950 46 84 73 47 67 73 85 60 84 78

1960 82 94 51 77 93 78 92 102 137 116

1970 142 122 116 84 130 114 126 113 129 158

1980 140 126 149 110 152 184 174 154 153 117

1990 125 135 156 94 149 136 160 135 156 156

2000 146 149 84 113 226 117 141 158 158 223

2010 169 163 165 147 120 37

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157B 1902 to 2015 114 years Series 20

[\*] Early part of series cannot be checked from 1902 to 1902 -- not matched by another series

[B] Entire series, effect on correlation ( .658) is:

Lower 1914< -.047 1981> -.021 1904< -.016 1926> -.013 1930< -.007 1971> -.007 Higher 2015 .064 1989 .012

157B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 192 221 183 173 193 160 150 160

1910 127 105 89 82 43 64 98 59 64 44

1920 61 48 67 52 44 40 71 55 62 77

1930 54 65 84 70 95 100 90 92 77 86

1940 88 74 82 52 52 58 48 55 28 43

1950 55 80 60 43 64 79 81 44 82 63

1960 55 80 57 89 94 69 77 83 119 114

1970 106 129 133 110 107 91 102 107 105 128

1980 102 127 146 109 147 157 192 166 127 92

1990 86 130 204 149 207 201 175 135 150 181

2000 174 178 154 139 210 146 145 164 196 218

2010 182 157 145 167 176 62

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186A 1908 to 2015 108 years Series 21

[B] Entire series, effect on correlation ( .637) is:

Lower 1981> -.033 1963< -.014 1975> -.012 1908> -.011 1912< -.010 1911> -.010 Higher 2015 .099 1989 .021

186A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1908 121 118

1910 122 121 67 58 65 58 48 60 33 29

1920 25 25 41 56 27 9 16 26 53 109

1930 52 97 115 128 155 193 51 48 53 77

1940 102 50 33 52 105 61 56 70 48 79

1950 30 83 115 139 166 288 175 57 125 169

1960 203 168 175 129 128 114 127 133 218 166

1970 183 135 178 236 170 188 161 174 176 177

1980 145 179 215 169 193 170 180 151 115 67

1990 66 119 173 120 134 178 186 146 148 102

2000 65 107 103 115 174 116 163 122 115 142

2010 165 153 128 113 113 60

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186B 1918 to 2015 98 years Series 22

[B] Entire series, effect on correlation ( .625) is:

Lower 1981> -.051 1999< -.020 1956> -.014 2002> -.014 1923> -.009 1949> -.008 Higher 2015 .105 1968 .014

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

1981 +3.7 SD

186B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1918 76 66

1920 49 27 39 62 47 18 7 6 19 48

1930 31 54 48 67 68 75 45 72 75 89

1940 99 61 59 68 101 61 47 92 44 77

1950 22 55 78 101 129 166 203 56 68 114

1960 109 99 101 135 120 114 119 127 271 207

1970 198 139 169 181 166 142 183 165 173 162

1980 150 219 198 145 178 160 213 195 122 106

1990 121 171 228 149 212 253 356 263 251 125

2000 126 216 222 193 259 195 167 155 188 208

2010 235 239 198 181 310 70

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224A 1903 to 2015 113 years Series 23

[B] Entire series, effect on correlation ( .552) is:

Lower 1981> -.031 1905< -.029 1983< -.014 1961< -.012 2012< -.012 1975> -.011 Higher 2015 .032 1989 .017

224A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 189 218 122 89 114 100 109

1910 106 106 75 75 73 71 66 85 62 61

1920 52 36 72 52 20 9 10 28 39 107

1930 67 113 93 126 126 115 73 57 100 124

1940 96 43 58 89 116 90 69 78 32 41

1950 23 56 92 101 129 148 110 55 83 88

1960 96 66 115 164 161 93 136 128 230 130

1970 98 92 115 181 157 161 171 133 169 150

1980 130 168 158 90 166 180 141 146 144 104

1990 104 157 245 189 256 323 277 219 178 149

2000 163 247 200 158 227 174 113 119 130 168

2010 132 136 67 85 112 53

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224B 1905 to 2015 111 years Series 24

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

Lower 1971< -.022 1981> -.018 1961< -.016 2003> -.015 1909< -.009 1932< -.009 Higher 2015 .062 1989 .025

224B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 231 106 113 76 57

1910 73 69 62 62 42 30 32 56 47 23

1920 27 23 53 38 17 10 16 31 59 80

1930 48 60 38 44 55 54 56 51 88 89

1940 73 26 26 33 84 70 37 71 31 27

1950 15 46 59 96 103 127 95 60 82 108

1960 96 75 129 217 148 113 150 148 227 144

1970 188 119 199 216 174 169 196 161 156 226

1980 147 143 168 89 126 95 92 75 68 39

1990 63 108 156 130 183 144 174 103 132 131

2000 102 99 81 145 181 136 133 131 109 153

2010 161 134 89 102 163 54

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347A 1911 to 2015 105 years Series 25

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

Lower 1981< -.044 1994< -.018 1979< -.016 2002> -.010 1989> -.010 1980> -.009 Higher 2015 .034 1957 .015

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

1980 1981 -4.2 SD

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

1981 -6.9 SD

347A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1911 81 69 83 104 138 154 169 138 126

1920 155 89 105 123 103 83 110 135 114 239

1930 295 370 362 195 178 172 119 228 255 250

1940 245 170 221 213 209 134 128 187 151 162

1950 152 281 197 133 199 273 201 94 157 196

1960 262 209 243 323 315 224 251 254 258 185

1970 179 189 183 168 146 113 131 141 149 116

1980 118 65 100 110 112 113 110 139 121 104

1990 104 105 135 116 91 129 135 137 183 168

2000 142 116 129 111 179 164 109 91 137 186

2010 148 118 117 127 136 54

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347B 1924 to 2015 92 years Series 26

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

Lower 1989> -.022 1983> -.022 1975< -.020 1985< -.015 1952< -.014 1925> -.012 Higher 2015 .040 1981 .019

347B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 123 128 111 81 97 174

1930 175 245 180 124 164 151 138 127 121 120

1940 162 121 191 139 138 120 126 146 115 117

1950 111 215 127 113 166 206 213 151 256 197

1960 290 225 211 314 276 165 172 157 249 200

1970 189 180 196 161 147 87 92 108 123 115

1980 96 70 114 147 139 96 103 107 136 125

1990 114 83 136 101 148 213 233 187 194 165

2000 146 156 131 96 150 136 88 111 116 197

2010 128 84 121 146 129 40

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360A 1947 to 2015 69 years Series 27

[B] Entire series, effect on correlation ( .665) is:

Lower 1975< -.056 1981> -.033 1952> -.014 1978< -.013 1980> -.012 1972< -.011 Higher 2015 .067 1989 .020

360A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 138 71 65

1950 58 107 212 109 148 121 89 55 72 91

1960 132 107 94 132 114 93 100 115 166 122

1970 133 123 109 115 154 91 97 149 117 139

1980 149 167 199 164 227 196 163 190 141 111

1990 118 187 212 166 334 327 361 280 305 272

2000 286 272 246 242 334 241 186 225 267 399

2010 302 313 290 211 265 81

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360B 1931 to 2015 85 years Series 28

[B] Entire series, effect on correlation ( .640) is:

Lower 1953> -.030 1949> -.020 1965> -.016 2002> -.011 1981> -.010 1936< -.010 Higher 2015 .135 1968 .015

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

1953 +3.0 SD

360B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 260 380 243 172 160 49 35 37 42

1940 41 31 26 50 42 50 33 78 40 60

1950 37 35 55 105 94 95 80 58 80 60

1960 93 85 72 99 82 113 104 105 170 137

1970 135 128 123 141 136 110 93 134 118 127

1980 106 122 163 156 218 175 220 218 163 157

1990 121 146 213 155 337 391 403 332 421 372

2000 293 281 279 179 247 199 163 171 240 363

2010 327 257 268 228 231 63

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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 123A 1909 2015 107 4 0 .698 1.05 2.88 .551 .751 .276 2.45 .321 -.064 1

2 123B 1906 2015 110 4 0 .634 1.00 3.06 .529 .758 .281 2.66 .405 .032 1

3 124A 1907 2015 109 4 0 .721 1.54 2.79 .587 .758 .224 2.65 .481 -.065 1

4 124B 1904 2015 112 4 0 .664 1.46 3.99 .749 .767 .273 2.91 .484 .002 2

5 130A 1906 2015 110 4 1 .431 1.65 3.74 .599 .642 .237 2.77 .435 -.049 1

6 130B 1916 2015 100 4 1 .352 1.65 2.88 .515 .580 .225 2.69 .513 -.034 1

7 136A 1920 2015 96 4 0 .687 1.28 3.14 .612 .784 .260 2.61 .422 -.054 2

8 136B 1905 2015 111 4 0 .651 1.04 3.24 .638 .837 .342 2.59 .475 .108 1

9 137A 1911 2015 105 4 0 .494 1.17 2.80 .707 .892 .278 2.57 .435 -.018 1

10 137B 1924 2015 92 4 0 .589 1.29 2.41 .638 .837 .237 2.48 .366 -.005 2

11 138A 1906 2015 110 4 0 .531 1.82 3.86 .850 .734 .246 2.40 .308 -.058 1

12 138B 1922 2015 94 4 0 .694 1.87 4.04 .898 .716 .266 2.52 .365 -.073 1

13 139A 1926 2015 90 3 0 .621 .86 2.36 .411 .633 .286 2.76 .498 -.060 1

14 139B 1926 2015 90 3 0 .624 1.18 3.52 .659 .718 .285 2.76 .527 -.031 1

15 146A 1907 2015 109 4 0 .636 1.27 2.79 .432 .675 .228 2.59 .430 .022 1

16 146B 1908 2015 108 4 0 .593 1.39 3.86 .520 .665 .226 2.53 .430 .086 1

17 155A 1943 2015 73 3 0 .646 1.53 2.82 .509 .541 .249 2.63 .517 -.026 1

18 155B 1937 2015 79 3 0 .756 1.53 3.11 .671 .803 .215 2.46 .414 .049 1

19 157A 1903 2015 113 4 0 .580 1.06 2.37 .472 .789 .227 2.67 .484 -.043 1

20 157B 1902 2015 114 4 0 .658 1.08 2.21 .501 .850 .217 2.46 .427 .017 1

21 186A 1908 2015 108 4 0 .637 1.16 2.88 .570 .743 .303 2.68 .426 .036 1

22 186B 1918 2015 98 4 0 .625 1.31 3.56 .745 .766 .306 2.78 .444 .017 1

23 224A 1903 2015 113 4 0 .552 1.18 3.23 .587 .772 .296 2.75 .463 .006 2

24 224B 1905 2015 111 4 0 .626 .98 2.31 .554 .759 .322 2.74 .532 .023 1

25 347A 1911 2015 105 4 0 .534 1.61 3.70 .640 .729 .213 2.38 .286 -.023 2

26 347B 1924 2015 92 4 0 .598 1.49 3.14 .505 .591 .234 2.71 .505 .037 1

27 360A 1947 2015 69 3 0 .665 1.76 3.99 .844 .785 .245 2.67 .467 .069 1

28 360B 1931 2015 85 3 0 .640 1.55 4.21 1.018 .867 .252 2.79 .410 -.050 1

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Total or mean: 2813 106 2 .609 1.34 4.21 .620 .743 .260 2.91 .437 -.005

- = [ COFECHA FAGR COF ] = -