[] Dendrochronology Program Library Run FAGR Program COF 08:44 Wed 04 Oct 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30229

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: FAGR\_IBR\_CORR1-50

File of DATED series: FAGR\_IBR\_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 1901 to 2016 116 years

Continuous time span is 1901 to 2016 116 years

Portion with two or more series is 1904 to 2016 113 years

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

\*C\* Number of dated series 33 \*C\*

\*O\* Master series 1901 2016 116 yrs \*O\*

\*F\* Total rings in all series 3222 \*F\*

\*E\* Total dated rings checked 3219 \*E\*

\*C\* Series intercorrelation .633 \*C\*

\*H\* Average mean sensitivity .232 \*H\*

\*A\* Segments, possible problems 3 \*A\*

\*\*\* Mean length of series 97.6 \*\*\*

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

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

No ring measurements of zero value

1950 -3.013 33 2000 -.940 32

1901 .711 1 1951 .083 33 2001 .576 32

1902 1.683 1 1952 -.094 33 2002 -.402 32

1903 1.585 1 1953 -1.368 33 2003 .046 32

1904 1.422 2 1954 .733 33 2004 1.393 32

1905 .159 5 1955 1.017 33 2005 .619 32

1906 .343 6 1956 -.939 33 2006 -1.253 32

1907 -1.150 7 1957 -.294 33 2007 .093 32

1908 -1.081 7 1958 1.345 33 2008 .348 32

1909 -.711 7 1959 .566 33 2009 1.686 32

1910 .214 8 1960 -.015 33 2010 -.010 32

1911 -.813 10 1961 .742 33 2011 -.503 32

1912 .841 10 1962 1.287 33 2012 .271 32

1913 .989 10 1963 -.766 33 2013 -1.260 32

1914 .854 12 1964 -.025 33 2014 .582 32

1915 .318 12 1965 -.086 33 2015 .592 32

1916 .176 13 1966 -1.053 33 2016 -1.000 32

1917 -.400 16 1967 -.933 33

1918 -.247 18 1968 .431 33

1919 -1.109 20 1969 .385 33

1920 .271 20 1970 .975 33

1921 -.774 22 1971 .964 33

1922 -.110 23 1972 1.626 33

1923 -.962 23 1973 .585 33

1924 -.705 24 1974 .420 33

1925 -.094 24 1975 -.898 33

1926 -.347 25 1976 -2.086 33

1927 .888 27 1977 -1.750 33

1928 1.295 27 1978 -.366 33

1929 1.076 29 1979 .263 33

1930 .799 29 1980 -.719 33

1931 1.322 29 1981 .099 33

1932 1.462 29 1982 .736 33

1933 -1.255 29 1983 -.657 33

1934 -.573 30 1984 -1.376 33

1935 .170 30 1985 .681 33

1936 -3.189 30 1986 -.253 33

1937 -1.300 32 1987 .749 33

1938 -.341 32 1988 .154 33

1939 .342 32 1989 .197 33

1940 .346 32 1990 .044 33

1941 -1.096 32 1991 .988 32

1942 .928 32 1992 .998 32

1943 1.278 32 1993 .610 32

1944 .936 32 1994 .404 32

1945 .614 33 1995 -.608 32

1946 .053 33 1996 -3.033 32

1947 .651 33 1997 -1.696 32

1948 .308 33 1998 -.242 32

1949 -2.063 33 1999 .638 32

PART 5: CORRELATION OF SERIES BY SEGMENTS: FAGR\_IBR\_CORR1-50 08:44 Wed 04 Oct 2017 Page 5

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Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1900 1925 1950 1975

1949 1974 1999 2024

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

1 1429A 1911 2016 .76 .83 .71 .68

2 1429B 1929 2016 .65 .61 .61

3 1430A 1927 2016 .75 .65 .50

4 1430B 1926 2016 .56 .45 .32B

5 1431A 1918 2016 .83 .82 .75 .57

6 1431B 1917 2016 .65 .64 .62 .57

7 1432A 1904 2016 .78 .82 .67 .67

8 1432B 1914 2016 .84 .81 .63 .51

9 1433A 1934 2016 .69 .72 .73

10 1433B 1905 2016 .60 .42 .52 .67

11 1434A 1901 2016 .53 .66 .52 .56

12 1434B 1924 2016 .62 .61 .61 .68

13 1435A 1927 2016 .49 .43 .34

14 1435B 1919 2016 .73 .77 .51 .44

15 1436A 1917 2016 .79 .81 .53 .38

16 1436B 1914 2016 .59 .61 .67 .58

17 1437A 1916 2016 .79 .82 .77 .74

18 1437B 1907 2016 .73 .79 .65 .63

19 1438A 1921 2016 .79 .79 .57 .57

20 1438B 1919 2016 .75 .83 .72 .68

21 1888B 1937 2016 .56 .57 .64

22 1889A 1921 2016 .66 .67 .65 .67

23 1889B 1918 2016 .59 .55 .68 .72

24 1890A 1937 2016 .49 .58 .65

25 1890B 1945 2016 .64 .66 .73

26 1891A 1910 2016 .77 .85 .69 .56

27 1891B 1922 2016 .85 .80 .69 .61

28 1892A 1911 2016 .75 .70 .38B .30B

29 1892B 1929 2016 .69 .47 .50

30 1893A 1905 2016 .71 .77 .65 .59

31 1893B 1906 1990 .52 .71 .62

32 1894A 1905 2016 .59 .77 .70 .76

33 1894B 1917 2016 .78 .79 .65 .60

Av segment correlation .71 .70 .62 .59

PART 6: POTENTIAL PROBLEMS: FAGR\_IBR\_CORR1-50 08:44 Wed 04 Oct 2017 Page 5

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For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged 50-year segments of series filtered with 32-year spline,

at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year

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1429A 1911 to 2016 106 years Series 1

[B] Entire series, effect on correlation ( .699) is:

Lower 2000< -.040 1912< -.027 1951< -.014 1993< -.010 1984> -.009 1917> -.008 Higher 1936 .025 1996 .020

1429A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1911 43 22 181 185 172 226 269 232 237

1920 279 181 218 219 209 226 196 256 304 304

1930 283 309 349 216 246 249 156 181 257 279

1940 240 197 237 244 225 217 178 193 174 124

1950 80 92 132 103 132 145 106 98 132 123

1960 121 128 113 114 120 111 102 102 132 111

1970 139 150 186 160 158 106 55 64 75 98

1980 84 105 132 79 104 123 133 130 121 93

1990 110 126 98 75 94 93 59 93 110 112

2000 48 103 82 100 122 131 113 147 144 162

2010 130 94 109 73 96 106 58

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1429B 1929 to 2016 88 years Series 2

[B] Entire series, effect on correlation ( .645) is:

Lower 1976< -.028 1930< -.018 1984> -.015 2006> -.014 1997> -.008 1975> -.008 Higher 1950 .018 1936 .015

1429B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1929 377

1930 225 267 361 251 325 336 180 173 276 267

1940 249 195 249 277 234 204 167 150 152 116

1950 76 142 117 94 109 134 102 118 154 143

1960 116 131 147 118 122 114 108 77 91 81

1970 86 86 132 103 100 98 36 60 77 100

1980 85 90 109 85 110 138 128 113 105 78

1990 76 108 81 70 80 72 53 95 87 107

2000 48 97 64 94 149 131 125 147 127 181

2010 132 116 124 91 103 125 92

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1430A 1927 to 2016 90 years Series 3

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

Lower 1976> -.019 1953< -.015 2009< -.015 2013> -.015 2016> -.015 1927< -.009 Higher 1936 .052 1996 .023

1430A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 363 418 429

1930 328 403 559 224 334 468 175 250 332 353

1940 302 214 285 275 263 258 262 278 199 137

1950 123 173 161 92 175 184 153 172 223 214

1960 160 164 205 152 169 150 139 124 163 161

1970 147 156 189 151 176 144 158 161 200 157

1980 115 167 136 105 117 142 141 161 175 174

1990 167 173 149 160 112 95 53 60 76 138

2000 79 91 67 63 64 64 49 50 45 40

2010 27 38 30 38 55 56 44

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1430B 1926 to 2016 91 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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1967 2016 -8 .29 .08 .44\* .11 .02 -.13 .01 -.22 .06 -.21 .32| - - - - - - - - - -

[B] Entire series, effect on correlation ( .464) is:

Lower 2004< -.036 1938< -.020 1927< -.018 1971< -.016 1985< -.016 1932< -.014 Higher 1949 .044 1936 .026

1967 to 2016 segment:

Lower 2004< -.080 1971< -.036 1985< -.035 1997> -.023 2011> -.023 2000> -.022 Higher 1976 .044 2006 .030

1430B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 415 333 581 708

1930 648 693 449 209 305 465 185 226 230 295

1940 277 196 320 358 296 316 341 331 338 186

1950 179 310 265 187 208 210 173 191 272 199

1960 158 215 206 132 147 155 119 114 135 140

1970 157 127 166 170 164 107 85 89 116 121

1980 98 167 124 82 64 76 54 94 108 106

1990 103 106 101 107 104 92 66 97 111 100

2000 79 100 66 48 27 33 22 34 38 66

2010 41 76 70 49 48 63 48

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1431A 1918 to 2016 99 years Series 5

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

Lower 2006> -.017 2009< -.013 2016> -.012 2010> -.010 2002< -.009 1936> -.008 Higher 1950 .016 1949 .009

1431A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1918 372 269

1920 439 330 318 245 294 303 321 416 582 488

1930 470 549 525 303 316 391 243 200 246 260

1940 269 220 290 269 259 216 244 264 220 163

1950 121 175 191 170 232 248 180 240 299 240

1960 201 229 296 220 225 205 163 186 177 165

1970 157 180 192 151 166 141 67 77 64 75

1980 74 78 95 63 54 64 72 79 96 80

1990 81 85 78 77 58 58 41 45 54 62

2000 35 63 39 49 65 59 58 61 59 52

2010 59 50 52 32 51 70 65

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1431B 1917 to 2016 100 years Series 6

[B] Entire series, effect on correlation ( .608) is:

Lower 1936> -.028 1996> -.023 2000< -.010 1968< -.010 1953> -.010 1917> -.009 Higher 1933 .020 1950 .018

1431B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1917 322 263 167

1920 286 200 191 156 196 289 257 356 253 212

1930 244 244 232 104 115 146 135 149 176 224

1940 249 218 264 214 200 181 190 176 221 174

1950 114 216 241 241 326 298 205 265 291 248

1960 249 276 285 206 199 194 175 182 157 203

1970 203 205 217 172 185 158 117 111 86 112

1980 58 67 84 66 65 93 70 79 92 105

1990 74 113 94 97 102 79 69 73 76 72

2000 26 52 45 54 100 98 73 98 98 106

2010 98 85 90 70 86 79 68

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1432A 1904 to 2016 113 years Series 7

[B] Entire series, effect on correlation ( .718) is:

Lower 2006> -.017 1984> -.009 1917> -.007 1986> -.007 1941> -.007 1904> -.006 Higher 1936 .049 1996 .020

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

1976 -4.9 SD

1432A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 62 36 32 20 28 42

1910 36 26 149 282 305 201 283 309 257 200

1920 257 207 207 175 180 218 154 261 296 275

1930 264 352 348 194 212 197 46 119 179 231

1940 247 216 242 241 229 220 208 214 223 138

1950 110 126 124 118 157 165 123 119 183 162

1960 134 135 156 145 150 138 132 146 158 158

1970 142 166 175 148 150 114 68 108 140 138

1980 132 140 185 98 117 129 136 107 96 87

1990 90 114 107 101 94 78 51 82 95 107

2000 82 117 134 138 233 146 159 184 158 214

2010 157 156 148 101 139 164 76

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1432B 1914 to 2016 103 years Series 8

[B] Entire series, effect on correlation ( .699) is:

Lower 2014< -.021 2010> -.016 1986> -.013 1969< -.012 1993< -.012 1967> -.010 Higher 1936 .056 1950 .014

1432B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1914 414 328 341 224 266 231

1920 367 273 274 217 259 283 224 384 322 299

1930 318 368 308 207 220 226 103 177 223 248

1940 248 196 271 276 269 257 247 261 243 173

1950 129 184 201 185 236 210 170 193 206 214

1960 188 167 203 171 179 167 148 176 193 133

1970 152 138 170 128 101 90 61 62 92 105

1980 97 125 152 112 129 172 188 142 126 101

1990 116 143 129 81 81 72 62 81 89 126

2000 62 93 85 87 101 93 90 113 105 185

2010 180 130 124 84 59 82 94

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1433A 1934 to 2016 83 years Series 9

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

Lower 2006> -.023 1961< -.019 1941> -.011 1956< -.009 1963> -.009 2005< -.008 Higher 1996 .017 1949 .010

1433A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1934 138 168 106 113 202 290

1940 334 292 320 319 278 275 210 237 196 152

1950 138 198 209 183 248 227 165 180 224 229

1960 215 189 242 230 220 202 175 209 254 268

1970 267 255 244 214 211 163 152 155 160 189

1980 167 187 189 142 147 208 185 204 158 150

1990 129 159 145 127 115 92 75 88 86 118

2000 93 123 103 128 147 114 128 153 141 199

2010 159 119 132 102 109 106 68

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1433B 1905 to 2016 112 years Series 10

[B] Entire series, effect on correlation ( .526) is:

Lower 1960< -.068 1963> -.017 2010> -.012 2006> -.008 2016> -.008 1957< -.008 Higher 1996 .021 1976 .018

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

1960 -5.0 SD

1433B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 139 130 75 49 79

1910 252 193 395 272 251 191 217 214 238 178

1920 170 163 221 177 168 146 132 197 195 250

1930 335 383 260 135 96 101 58 48 85 93

1940 118 133 184 169 176 158 146 165 191 142

1950 96 130 155 150 179 200 105 91 144 164

1960 79 142 160 187 151 139 160 165 208 174

1970 176 176 187 148 126 111 60 97 104 109

1980 89 89 123 67 58 111 115 124 117 105

1990 140 138 122 97 90 92 64 104 99 143

2000 77 119 96 129 147 147 138 159 136 200

2010 193 108 143 90 112 115 127

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1434A 1901 to 2016 116 years Series 11

[\*] Early part of series cannot be checked from 1901 to 1903 -- not matched by another series

[B] Entire series, effect on correlation ( .544) is:

Lower 1921< -.055 2015< -.022 1976> -.014 1904< -.012 1953> -.010 2013> -.010 Higher 1936 .035 1996 .023

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

1921 1922 4.1 SD

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

1921 -5.5 SD

1434A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 150 188 170 125 71 59 42 44 80

1910 92 67 90 89 93 98 107 100 100 92

1920 120 79 157 149 153 143 154 201 254 258

1930 259 282 248 186 203 215 124 160 187 185

1940 200 166 254 269 256 202 191 167 115 93

1950 107 162 111 127 143 142 94 89 107 122

1960 105 138 155 129 177 126 124 71 84 96

1970 130 130 137 131 107 110 105 90 84 108

1980 76 71 91 58 54 71 65 76 99 80

1990 99 85 105 123 118 100 40 40 59 52

2000 32 60 49 77 100 91 62 79 93 97

2010 79 68 96 93 124 86 87

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1434B 1924 to 2016 93 years Series 12

[B] Entire series, effect on correlation ( .633) is:

Lower 1929< -.038 2000> -.030 1977> -.015 1983< -.015 1956> -.013 1997> -.012 Higher 1996 .043 1936 .028

1434B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 353 399 352 354 375 258

1930 298 320 351 226 272 291 189 223 326 330

1940 272 224 298 296 334 257 246 283 236 200

1950 163 181 171 179 191 228 222 287 246 243

1960 210 247 206 184 224 204 186 139 243 220

1970 226 221 242 219 154 161 121 181 161 168

1980 124 131 132 90 104 156 124 149 163 154

1990 150 162 165 175 186 166 127 203 183 249

2000 238 223 179 210 226 221 175 207 195 216

2010 184 155 187 129 188 159 106

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1435A 1927 to 2016 90 years Series 13

[B] Entire series, effect on correlation ( .423) is:

Lower 1933> -.021 1980> -.019 1956> -.017 2001< -.015 1975< -.015 1928< -.015 Higher 1949 .042 2016 .013

1435A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 230 189 429

1930 593 516 335 378 417 413 217 193 210 205

1940 212 220 285 387 324 275 252 294 287 137

1950 173 208 192 172 301 259 257 265 286 215

1960 199 212 241 162 206 188 154 197 157 206

1970 227 208 176 179 188 87 118 107 143 126

1980 174 149 149 148 121 131 97 136 128 139

1990 111 158 153 118 149 100 109 118 119 110

2000 115 109 134 117 159 119 132 145 154 173

2010 143 175 131 150 219 169 91

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1435B 1919 to 2016 98 years Series 14

[B] Entire series, effect on correlation ( .550) is:

Lower 2000> -.032 1998< -.020 1919> -.014 1975< -.014 1956> -.013 1987< -.010 Higher 1936 .027 1996 .017

1435B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 235

1920 236 101 96 95 146 217 185 427 359 320

1930 296 420 436 271 371 345 201 263 244 258

1940 252 210 263 310 275 281 205 224 179 156

1950 168 236 168 158 245 251 227 245 301 231

1960 252 248 234 127 140 127 115 127 160 140

1970 177 186 194 154 182 80 107 113 128 139

1980 95 107 134 101 123 109 122 106 123 103

1990 120 127 183 169 192 139 109 144 109 142

2000 197 160 169 149 217 158 166 225 176 248

2010 146 185 175 160 189 177 124

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1436A 1917 to 2016 100 years Series 15

[B] Entire series, effect on correlation ( .573) is:

Lower 1984< -.055 2000> -.032 2011> -.025 1956> -.019 1999< -.008 2007< -.008 Higher 1936 .040 1949 .019

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

2011 +3.7 SD

1436A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1917 82 88 73

1920 96 102 136 119 137 159 189 175 240 223

1930 164 216 213 115 171 172 84 151 186 162

1940 154 117 234 225 229 239 208 243 184 100

1950 104 160 125 125 183 184 200 179 210 219

1960 198 194 232 167 185 189 144 145 211 191

1970 208 206 249 222 170 166 132 145 209 163

1980 150 155 144 146 87 138 131 178 132 128

1990 149 150 190 193 194 162 142 190 240 200

2000 288 238 262 269 414 278 234 200 252 313

2010 232 523 318 228 206 232 161

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1436B 1914 to 2016 103 years Series 16

[B] Entire series, effect on correlation ( .568) is:

Lower 1936> -.045 1939< -.014 1976> -.012 1980> -.009 2000> -.008 1984< -.008 Higher 1996 .048 2004 .011

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

1996 -5.5 SD

1436B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1914 70 60 82 69 64 61

1920 101 117 158 139 130 156 187 266 315 267

1930 205 184 160 94 135 161 141 159 119 78

1940 107 59 117 133 188 127 121 169 138 103

1950 85 137 119 84 114 133 108 115 201 151

1960 129 135 184 131 171 169 136 134 204 158

1970 172 177 211 235 196 147 147 92 134 125

1980 146 132 113 121 67 120 121 174 123 146

1990 156 133 150 150 131 107 55 139 170 166

2000 161 159 162 152 301 209 171 171 192 213

2010 146 176 201 134 116 84 54

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1437A 1916 to 2016 101 years Series 17

[B] Entire series, effect on correlation ( .773) is:

Lower 1946< -.019 2000> -.015 1987< -.010 1983> -.009 1937> -.007 1953> -.006 Higher 1936 .040 1996 .012

1437A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 168 173 180 101

1920 136 138 139 113 78 195 267 365 376 305

1930 318 367 344 199 201 222 51 231 202 244

1940 257 182 211 225 220 190 125 163 155 121

1950 109 159 159 146 181 200 138 130 194 138

1960 116 131 173 136 144 145 116 99 115 129

1970 151 152 200 150 126 87 65 63 99 116

1980 77 89 98 88 57 97 57 54 75 66

1990 77 71 73 62 54 53 29 23 49 56

2000 68 80 85 91 143 96 48 92 85 113

2010 68 51 92 31 48 40 34

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1437B 1907 to 2016 110 years Series 18

[B] Entire series, effect on correlation ( .695) is:

Lower 1956< -.016 1983> -.014 2000> -.014 1984> -.012 1909> -.008 1937> -.007 Higher 1936 .044 2006 .008

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

1956 -4.9 SD

1437B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1907 35 100 159

1910 125 84 230 197 200 245 174 174 173 79

1920 98 89 97 102 87 119 262 327 526 471

1930 448 459 404 193 198 258 58 254 208 175

1940 180 134 210 208 235 187 175 196 184 134

1950 122 223 190 128 135 135 83 114 147 135

1960 111 129 142 90 118 144 114 88 99 111

1970 139 185 195 160 122 91 75 45 66 76

1980 52 73 84 105 110 115 112 111 69 68

1990 55 71 86 61 41 34 15 6 18 41

2000 47 83 58 75 73 47 22 46 48 66

2010 44 48 65 57 140 96 70

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1438A 1921 to 2016 96 years Series 19

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

Lower 2000> -.023 1961< -.019 1956> -.016 1983> -.016 1992< -.009 1993< -.008 Higher 1936 .058 1949 .014

1438A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1921 164 231 187 239 293 266 319 333 286

1930 241 348 420 218 307 391 118 224 325 355

1940 360 306 461 462 367 375 315 393 311 215

1950 223 431 364 280 436 378 371 321 410 345

1960 353 281 436 283 277 334 324 312 285 358

1970 342 365 318 306 310 242 189 172 206 193

1980 196 214 266 234 185 249 168 189 112 137

1990 133 149 95 75 71 77 53 53 76 101

2000 105 93 88 73 124 148 56 78 103 103

2010 82 47 80 33 97 90 72

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1438B 1919 to 2016 98 years Series 20

[B] Entire series, effect on correlation ( .709) is:

Lower 1920< -.031 2002< -.027 1986> -.013 1975> -.011 1981< -.009 2000> -.008 Higher 1936 .048 1996 .021

1438B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 136

1920 91 196 428 357 317 409 362 517 415 350

1930 415 531 462 199 210 256 127 267 261 263

1940 220 167 298 397 271 251 236 304 276 194

1950 187 307 243 182 243 239 208 184 238 204

1960 189 239 225 172 175 195 175 146 239 223

1970 215 233 239 195 171 172 117 115 126 157

1980 125 103 130 116 99 143 171 160 103 119

1990 119 105 106 105 84 74 47 42 85 126

2000 88 108 45 81 94 101 63 66 75 92

2010 70 47 77 49 107 77 59

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1888B 1937 to 2016 80 years Series 21

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

Lower 1953> -.034 1950> -.019 2013> -.014 2009< -.013 1963> -.013 1992< -.010 Higher 1949 .045 1996 .040

1888B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 110 131 145

1940 103 63 88 105 121 145 154 209 269 117

1950 142 177 158 276 300 338 229 238 292 267

1960 280 310 307 300 262 232 205 239 358 396

1970 331 297 268 239 193 175 148 149 207 165

1980 167 224 181 91 59 124 141 215 121 141

1990 118 160 94 84 79 79 37 24 52 55

2000 46 88 44 63 52 28 12 23 36 41

2010 7 8 43 61 123 103 40

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1889A 1921 to 2016 96 years Series 22

[B] Entire series, effect on correlation ( .656) is:

Lower 1936> -.014 1986< -.013 1966> -.012 2004< -.012 1921> -.010 1951< -.008 Higher 1950 .016 1996 .016

1889A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1921 240 259 155 139 139 164 298 297 318

1930 278 300 363 194 205 265 204 225 295 312

1940 254 168 281 289 276 271 216 260 225 161

1950 104 141 182 138 164 205 136 117 195 221

1960 140 153 132 122 110 129 142 95 107 100

1970 119 126 131 146 130 95 77 78 96 110

1980 110 143 150 109 95 125 78 135 140 138

1990 130 174 154 157 158 118 61 80 84 107

2000 55 92 83 91 80 108 70 61 73 104

2010 80 69 92 44 78 122 81

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1889B 1918 to 2016 99 years Series 23

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

Lower 1936> -.062 1971< -.021 1984> -.015 1962< -.009 1948< -.008 2007< -.007 Higher 1996 .039 1933 .017

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

1936 +3.4 SD

1889B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1918 368 208

1920 356 225 188 163 180 208 216 290 294 468

1930 468 445 484 215 224 354 321 230 296 389

1940 320 176 310 331 273 264 177 168 120 111

1950 80 155 165 153 263 259 185 179 253 269

1960 179 220 175 162 144 152 153 157 178 173

1970 212 156 174 149 163 135 130 135 135 185

1980 176 199 218 170 203 271 223 209 167 186

1990 185 194 187 211 218 144 88 145 158 185

2000 129 175 128 144 229 208 87 80 81 128

2010 92 91 114 82 189 213 153

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1890A 1937 to 2016 80 years Series 24

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

Lower 1956> -.029 1941> -.020 2013> -.010 1967> -.009 1953> -.009 1971< -.009 Higher 1996 .027 1949 .022

1890A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 124 118 254

1940 260 239 202 190 152 175 97 108 92 64

1950 79 123 184 182 228 240 263 302 274 223

1960 288 286 254 174 282 218 192 276 363 303

1970 304 228 259 213 236 158 175 137 266 229

1980 193 270 273 136 103 135 124 143 136 162

1990 219 231 167 183 122 97 49 58 145 113

2000 38 104 96 93 123 83 62 64 94 96

2010 75 62 65 64 70 102 52

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1890B 1945 to 2016 72 years Series 25

[B] Entire series, effect on correlation ( .712) is:

Lower 1956> -.017 1993< -.015 1947< -.012 1980> -.011 2006> -.009 2001< -.007 Higher 1996 .034 1949 .031

1890B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 140 128 115 156 71

1950 111 221 330 269 408 405 353 393 437 335

1960 425 415 363 239 358 318 261 316 400 353

1970 320 279 350 295 260 181 154 175 197 202

1980 237 311 339 215 206 239 244 243 233 272

1990 230 205 173 114 170 115 59 111 182 161

2000 94 106 95 146 220 150 126 143 155 238

2010 130 152 133 78 135 178 126

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1891A 1910 to 2016 107 years Series 26

[B] Entire series, effect on correlation ( .674) is:

Lower 2000> -.020 2016> -.015 1919> -.014 2015< -.012 1921> -.011 1910> -.007 Higher 1936 .057 1933 .015

1891A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1910 67 47 82 62 58 67 10 39 32 285

1920 494 459 398 387 349 416 370 417 416 370

1930 381 427 491 239 264 311 124 160 160 186

1940 244 233 293 293 320 345 296 252 275 173

1950 154 242 268 209 336 348 234 312 329 275

1960 231 271 272 219 268 279 242 170 192 199

1970 267 254 286 192 256 206 150 102 196 184

1980 142 147 176 137 104 115 72 88 96 70

1990 78 75 118 144 128 93 52 45 68 96

2000 103 97 98 81 118 104 32 53 78 129

2010 78 43 61 41 66 39 53

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1891B 1922 to 2016 95 years Series 27

[B] Entire series, effect on correlation ( .744) is:

Lower 1973< -.037 2013> -.012 2016> -.011 2000> -.011 1938< -.010 1984> -.007 Higher 1936 .048 1949 .015

1891B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1922 256 258 263 229 223 333 460 387

1930 424 455 463 240 241 266 79 179 146 233

1940 210 188 276 300 235 238 275 267 261 156

1950 125 203 241 178 185 222 160 190 200 200

1960 202 269 276 175 160 158 125 117 151 153

1970 163 173 202 131 139 136 114 113 111 152

1980 143 148 155 124 120 141 127 120 93 110

1990 104 163 176 118 95 76 50 54 73 83

2000 84 111 103 90 128 114 44 65 68 98

2010 51 23 34 50 69 72 61

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

1892A 1911 to 2016 106 years Series 28

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

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

1950 1999 10 .17 .03 -.12 .15 .17 -.28 -.03 .08 -.09 -.04 .38|-.20 -.07 .23 .03 -.22 -.05 -.03 -.30 -.19 .39\*

1967 2016 -10 .35\*-.08 .02 -.01 .27 -.12 -.13 -.04 -.03 .05 .30| - - - - - - - - - -

[B] Entire series, effect on correlation ( .518) is:

Lower 1986< -.042 1911> -.035 1976> -.031 2000> -.020 1983> -.014 1967> -.013 Higher 1949 .033 1936 .030

1950 to 1999 segment:

Lower 1976> -.064 1986< -.050 1983> -.029 1967> -.025 1980> -.022 1981< -.018 Higher 1950 .033 1963 .030

1967 to 2016 segment:

Lower 1976> -.058 1986< -.045 2000> -.036 1983> -.027 1967> -.023 1980> -.020 Higher 1996 .040 2006 .039

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

1976 +3.4 SD; 1986 -5.4 SD

1892A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1911 42 62 58 84 69 46 37 70 35

1920 86 70 104 104 108 125 240 436 428 505

1930 397 383 460 240 235 294 161 260 343 301

1940 270 164 224 309 355 317 317 304 306 174

1950 161 316 251 178 289 267 211 240 267 217

1960 222 233 176 108 118 144 139 217 207 183

1970 133 142 120 79 108 102 126 79 77 94

1980 96 58 56 78 44 65 22 60 43 47

1990 42 61 85 86 103 76 45 32 53 79

2000 86 79 83 62 88 86 45 73 61 93

2010 52 47 46 35 49 94 52

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1892B 1929 to 2016 88 years Series 29

[B] Entire series, effect on correlation ( .650) is:

Lower 1980> -.030 1973< -.019 1983> -.018 1972< -.012 1974< -.012 2010> -.010 Higher 1936 .033 1949 .023

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

1980 +3.2 SD

1892B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1929 437

1930 475 365 290 160 160 274 115 143 149 361

1940 317 219 345 363 257 218 242 305 322 167

1950 170 264 217 142 242 268 183 184 211 169

1960 236 271 268 166 186 182 140 159 128 132

1970 124 96 83 56 51 40 50 47 56 45

1980 80 49 40 53 36 43 36 49 57 56

1990 48 48 45 69 44 43 29 25 52 60

2000 33 59 35 42 51 54 28 53 49 77

2010 58 40 52 28 34 22 16

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1893A 1905 to 2016 112 years Series 30

[B] Entire series, effect on correlation ( .666) is:

Lower 2000> -.015 1917< -.011 1953< -.011 2013> -.010 1931< -.010 1976> -.010 Higher 1936 .018 1933 .010

1893A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 133 186 142 138 126

1910 167 106 194 196 162 204 178 106 107 99

1920 147 168 222 184 183 175 183 248 306 293

1930 212 157 210 106 105 143 69 107 132 152

1940 223 142 204 225 200 191 152 191 191 139

1950 119 175 172 112 164 164 146 202 207 206

1960 199 203 221 155 174 176 129 148 146 151

1970 196 226 256 241 172 143 130 128 102 112

1980 57 62 80 82 59 127 101 107 67 85

1990 75 87 110 97 119 93 55 56 98 96

2000 88 108 78 73 83 60 18 21 56 90

2010 39 24 32 39 66 66 47

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

1893B 1906 to 1990 85 years Series 31

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

Lower 1911< -.035 1907> -.019 1917< -.014 1990< -.013 1919> -.013 1921> -.012 Higher 1936 .033 1956 .017

1893B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 184 164 134 118

1910 133 57 155 156 137 116 90 54 91 152

1920 214 210 154 147 189 249 187 203 265 255

1930 195 215 233 112 94 112 47 95 132 182

1940 208 134 237 201 153 131 111 127 123 101

1950 97 207 149 135 143 150 93 84 135 108

1960 123 153 169 104 127 118 114 153 191 138

1970 159 148 135 97 81 83 73 73 81 84

1980 54 80 80 67 60 94 78 75 64 69

1990 46

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1894A 1905 to 2016 112 years Series 32

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

Lower 1911> -.031 1910< -.025 1919> -.015 1922< -.014 1959< -.013 2000> -.010 Higher 1936 .047 1996 .019

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

1910 1911 4.1 SD

1894A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1905 226 133 113 119 94

1910 62 269 253 277 278 237 176 200 176 276

1920 259 273 174 159 242 277 263 359 335 316

1930 256 318 389 196 209 181 82 144 190 306

1940 300 186 265 282 256 239 191 169 233 165

1950 124 205 201 143 187 191 120 141 179 143

1960 198 208 179 155 148 194 159 178 173 175

1970 211 202 197 172 156 135 122 106 151 148

1980 104 115 155 135 93 104 86 119 89 91

1990 74 98 139 109 76 54 30 35 77 90

2000 90 151 116 121 122 74 13 123 146 134

2010 52 57 122 67 105 79 48

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1894B 1917 to 2016 100 years Series 33

[B] Entire series, effect on correlation ( .674) is:

Lower 2006< -.033 2013> -.014 1980< -.010 1990< -.010 1984> -.007 1933> -.006 Higher 1936 .025 1949 .011

1894B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1917 279 302 173

1920 277 202 262 226 184 203 183 296 358 399

1930 369 334 349 181 202 182 88 134 221 206

1940 211 139 276 246 210 206 244 289 211 126

1950 128 269 202 153 199 220 187 190 208 174

1960 211 204 252 186 176 148 118 115 164 158

1970 188 176 193 174 124 103 80 107 123 164

1980 78 105 109 101 109 122 98 103 82 87

1990 63 113 155 149 113 102 55 41 102 146

2000 111 138 103 91 113 135 9 90 85 220

2010 89 66 88 103 130 99 54

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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 1429A 1911 2016 106 4 0 .699 1.50 3.49 .685 .848 .211 2.37 .365 -.008 1

2 1429B 1929 2016 88 3 0 .645 1.37 3.77 .715 .822 .228 2.48 .376 -.016 1

3 1430A 1927 2016 90 3 0 .672 1.72 5.59 1.050 .807 .209 2.58 .467 .001 1

4 1430B 1926 2016 91 3 1 .464 1.82 7.08 1.440 .875 .239 2.70 .548 -.013 5

5 1431A 1918 2016 99 4 0 .677 1.82 5.82 1.287 .917 .188 2.59 .468 -.040 1

6 1431B 1917 2016 100 4 0 .608 1.61 3.56 .786 .856 .198 2.51 .415 -.020 1

7 1432A 1904 2016 113 4 0 .718 1.56 3.52 .700 .786 .221 2.66 .400 .036 1

8 1432B 1914 2016 103 4 0 .699 1.78 4.14 .827 .849 .193 2.61 .407 -.004 1

9 1433A 1934 2016 83 3 0 .698 1.79 3.34 .611 .848 .159 2.76 .493 .036 1

10 1433B 1905 2016 112 4 0 .526 1.47 3.95 .611 .699 .234 2.62 .394 -.043 1

11 1434A 1901 2016 116 4 0 .544 1.20 2.82 .558 .866 .200 2.52 .355 -.051 1

12 1434B 1924 2016 93 4 0 .633 2.14 3.99 .664 .785 .164 2.54 .455 .005 1

13 1435A 1927 2016 90 3 0 .423 1.98 5.93 .941 .802 .193 2.47 .403 -.026 1

14 1435B 1919 2016 98 4 0 .550 1.92 4.36 .774 .740 .206 2.65 .466 -.053 1

15 1436A 1917 2016 100 4 0 .573 1.86 5.23 .656 .604 .202 2.65 .364 -.002 1

16 1436B 1914 2016 103 4 0 .568 1.44 3.15 .492 .656 .232 2.70 .354 .023 1

17 1437A 1916 2016 101 4 0 .773 1.35 3.76 .781 .832 .255 2.52 .377 .004 1

18 1437B 1907 2016 110 4 0 .695 1.34 5.26 .958 .838 .298 2.76 .424 -.001 1

19 1438A 1921 2016 96 4 0 .703 2.35 4.62 1.185 .820 .239 2.47 .389 .009 1

20 1438B 1919 2016 98 4 0 .709 1.90 5.31 1.096 .827 .246 2.65 .491 .020 2

21 1888B 1937 2016 80 3 0 .592 1.54 3.96 .973 .889 .309 2.58 .439 .005 3

22 1889A 1921 2016 96 4 0 .656 1.54 3.63 .737 .821 .224 2.50 .457 -.061 2

23 1889B 1918 2016 99 4 0 .646 2.03 4.84 .859 .715 .219 2.71 .472 .023 1

24 1890A 1937 2016 80 3 0 .571 1.68 3.63 .797 .804 .248 2.63 .450 .015 1

25 1890B 1945 2016 72 3 0 .712 2.25 4.37 1.008 .824 .251 2.71 .546 .053 1

26 1891A 1910 2016 107 4 0 .674 1.94 4.94 1.212 .870 .274 2.60 .431 .016 1

27 1891B 1922 2016 95 4 0 .744 1.71 4.63 .941 .856 .208 2.58 .430 -.061 2

28 1892A 1911 2016 106 4 2 .518 1.52 5.05 1.131 .881 .282 2.50 .436 -.007 1

29 1892B 1929 2016 88 3 0 .650 1.36 4.75 1.108 .873 .274 2.79 .655 .012 1

30 1893A 1905 2016 112 4 0 .666 1.37 3.06 .608 .809 .239 2.52 .453 .000 1

31 1893B 1906 1990 85 3 0 .552 1.32 2.65 .526 .697 .241 2.65 .433 -.007 1

32 1894A 1905 2016 112 4 0 .636 1.66 3.89 .768 .765 .270 2.53 .487 .017 2

33 1894B 1917 2016 100 4 0 .674 1.66 3.99 .773 .745 .281 2.56 .381 -.032 3

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Total or mean: 3222 122 3 .633 1.67 7.08 .851 .806 .232 2.79 .436 -.006

- = [ COFECHA FAGR COF ] = -