[] Dendrochronology Program Library Run FAGR Program COF 11:57 Tue 20 Dec 2016 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 29941

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: FAGR\_MMRB1400A\_Corr6-50

File of DATED series: FAGR\_MMRB1400A\_Corr6

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 1894 to 2015 122 years

Continuous time span is 1894 to 2015 122 years

Portion with two or more series is 1898 to 2015 118 years

>> 112A 2009 absent in 2 of 26 series, but is not usually narrow: master index is -.036

>> 112B 2009 absent in 2 of 26 series, but is not usually narrow: master index is -.036

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

\*C\* Number of dated series 26 \*C\*

\*O\* Master series 1894 2015 122 yrs \*O\*

\*F\* Total rings in all series 1729 \*F\*

\*E\* Total dated rings checked 1725 \*E\*

\*C\* Series intercorrelation .558 \*C\*

\*H\* Average mean sensitivity .276 \*H\*

\*A\* Segments, possible problems 4 \*A\*

\*\*\* Mean length of series 66.5 \*\*\*

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

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

103A 1 absent rings: 1936

112A 1 absent rings: 2009

112B 1 absent rings: 2009

1099B 3 absent rings: 1967 1968 1969

6 absent rings .347%

1900 1.608 2 1950 -.841 9 2000 -1.230 26

1901 .349 2 1951 .253 9 2001 -.136 26

1902 .839 2 1952 -.509 10 2002 .228 26

1903 -.123 2 1953 .361 10 2003 -.219 26

1904 -.108 2 1954 1.250 10 2004 1.439 26

1905 -1.107 2 1955 1.205 11 2005 .929 26

1906 -1.145 2 1956 .861 12 2006 .228 26

1907 -1.373 2 1957 .799 13 2007 .339 26

1908 -1.656 2 1958 1.212 13 2008 .554 26

1909 -.653 2 1959 .448 14 2009 -.036 26 2<<

1910 -1.380 2 1960 .499 15 2010 -1.895 26

1911 -1.566 2 1961 .958 16 2011 -.109 26

1912 -.597 2 1962 -.285 17 2012 .949 26

1913 -.754 3 1963 -.215 17 2013 .302 26

1914 .632 3 1964 .483 17 2014 .942 26

1915 1.076 3 1965 .378 18 2015 -.929 26

1916 1.254 3 1966 -1.025 18

1917 .611 4 1967 -.914 19 1

1918 .418 4 1968 -1.359 19 1

1919 -.426 5 1969 -.887 19 1

1920 .561 5 1970 -.707 19

1921 1.243 5 1971 -1.045 19

1922 1.280 6 1972 -2.090 19

1923 .516 6 1973 -.942 23

1924 .537 6 1974 .409 24

1925 .127 7 1975 1.074 24

1926 .016 7 1976 .764 24

1927 -.569 7 1977 1.278 24

1928 -.535 7 1978 .959 24

1929 -.416 7 1979 .109 24

1930 -.651 7 1980 .618 25

1931 .813 7 1981 .520 25

1932 .474 7 1982 .645 25

1933 -.581 8 1983 .324 25

1934 1.485 8 1984 .296 26

1935 1.149 8 1985 -1.065 26

1936 -5.699 8 1 1986 .163 26

1937 -.458 8 1987 .133 26

1938 .183 8 1988 -.665 26

1939 .766 8 1989 .169 26

1940 .367 8 1990 .100 26

1941 -.099 8 1991 -.452 26

1942 .771 9 1992 -.113 26

1943 .842 9 1993 .761 26

1894 .623 1 1944 .101 9 1994 -.055 26

1895 .982 1 1945 .283 9 1995 -.828 26

1896 -1.014 1 1946 -.395 9 1996 -1.537 26

1897 .735 1 1947 -.818 9 1997 -1.258 26

1898 1.155 2 1948 -2.049 9 1998 -.364 26

1899 1.689 2 1949 -.467 9 1999 -.076 26

PART 5: CORRELATION OF SERIES BY SEGMENTS: FAGR\_MMRB1400A\_Corr6-50 11:57 Tue 20 Dec 2016 Page 5

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Correlations of 50-year dated segments, lagged 25 years

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

Seq Series Time\_span 1875 1900 1925 1950 1975

1924 1949 1974 1999 2024

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

1 101A 1894 2015 .79 .79 .77 .47 .64

2 101B 1898 2015 .85 .85 .76 .35 .70

3 102A 1922 2015 .81 .83 .54 .45

4 102B 1913 2015 .81 .85 .59 .43B

5 103A 1925 2015 .38 .42 .57

6 103B 1984 2015 .51

7 111A 1965 2015 .57 .62

8 111B 1962 2015 .42 .46

9 112A 1955 2015 .49 .47

10 112B 1959 2015 .54 .44

11 113A 1967 2015 .35

12 113B 1961 2015 .22B .26A

13 1094A 1917 2015 .76 .78 .54 .66

14 1094B 1919 2015 .82 .79 .57 .65

15 1095A 1973 2015 .57

16 1095B 1973 2015 .43

17 1096A 1974 2015 .47

18 1096B 1942 2015 .45 .51 .60

19 1097A 1973 2015 .55

20 1097B 1980 2015 .48

21 1098A 1973 2015 .44

22 1098B 1957 2015 .43 .49

23 1099A 1956 2015 .34 .26A

24 1099B 1933 2015 .53 .65 .65

25 1448A 1952 2015 .44 .50

26 1448B 1960 2015 .42 .49

Av segment correlation .82 .81 .68 .47 .52

PART 6: POTENTIAL PROBLEMS: FAGR\_MMRB1400A\_Corr6-50 11:57 Tue 20 Dec 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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101A 1894 to 2015 122 years Series 1

[\*] Early part of series cannot be checked from 1894 to 1897 -- not matched by another series

[B] Entire series, effect on correlation ( .720) is:

Lower 1947< -.028 1922< -.011 1957< -.008 1994> -.008 2002< -.008 1959< -.007 Higher 1936 .169 2010 .006

101A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1894 18 25 15 32 46 56

1900 62 46 57 48 51 32 33 32 21 55

1910 37 33 76 126 231 263 217 208 229 172

1920 198 180 129 121 138 98 122 107 142 166

1930 122 173 192 121 138 140 20 117 107 135

1940 116 140 208 146 161 176 156 29 27 101

1950 138 155 136 171 186 175 170 114 179 106

1960 182 233 164 161 150 160 83 92 118 138

1970 154 118 121 171 228 200 189 181 193 108

1980 167 271 247 180 149 113 86 80 103 117

1990 116 78 115 130 144 101 58 94 77 77

2000 43 82 55 73 132 92 69 91 72 66

2010 34 79 120 79 124 44

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101B 1898 to 2015 118 years Series 2

[B] Entire series, effect on correlation ( .733) is:

Lower 1960< -.028 1947< -.016 1952> -.011 1913> -.009 1984< -.006 1961< -.006 Higher 1936 .139 2010 .010

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

1947 -4.7 SD

101B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1898 64 98

1900 99 53 77 42 47 27 28 23 24 55

1910 33 32 74 132 253 240 255 232 292 172

1920 216 193 177 105 81 51 62 47 41 55

1930 57 153 139 83 133 158 16 85 157 121

1940 119 112 158 127 108 120 118 58 58 111

1950 134 133 189 177 193 211 208 255 302 237

1960 112 122 102 146 160 243 200 206 218 273

1970 215 187 146 198 321 269 239 306 344 300

1980 364 363 262 277 158 98 113 155 66 66

1990 142 108 138 125 136 123 61 81 64 74

2000 55 84 81 85 165 137 137 133 137 132

2010 46 142 209 160 201 71

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102A 1922 to 2015 94 years Series 3

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

Lower 1941< -.022 2010> -.015 1988> -.014 2014< -.012 2012< -.009 1922> -.007 Higher 1936 .271 2004 .005

102A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1922 321 289 283 277 252 228 206 190

1930 188 193 137 93 143 119 10 69 92 103

1940 95 38 61 108 69 70 50 49 45 66

1950 51 63 41 84 84 59 49 75 77 49

1960 58 94 40 51 134 86 79 59 35 22

1970 36 39 17 35 99 157 222 246 223 230

1980 302 295 304 309 306 266 273 189 280 337

1990 312 124 140 179 112 81 78 73 62 76

2000 67 96 104 95 145 116 111 99 131 84

2010 66 87 51 23 15 13

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102B 1913 to 2015 103 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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1966 2015 -3 -.28 -.24 -.20 -.02 .16 .03 .12 .44\* .38 .09 .43| - - - - - - - - - -

[B] Entire series, effect on correlation ( .725) is:

Lower 2010> -.030 1913< -.024 1941< -.021 1914< -.009 2012< -.007 1985> -.007 Higher 1936 .317 1948 .005

1966 to 2015 segment:

Lower 2010> -.115 1998< -.030 2012< -.028 1987< -.027 2014< -.022 1985> -.020 Higher 2004 .045 1977 .031

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

1936 -4.7 SD; 2010 +3.5 SD

102B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1913 55 92 130 170 148 156 129

1920 163 214 178 183 170 170 173 141 120 147

1930 150 142 107 92 124 117 14 64 69 75

1940 83 38 48 76 51 49 47 42 25 46

1950 33 42 34 53 55 38 29 59 60 51

1960 38 55 26 24 66 33 34 26 10 11

1970 17 23 17 36 107 120 195 295 246 256

1980 285 262 274 293 296 240 223 140 101 150

1990 165 122 132 122 115 100 74 77 55 65

2000 51 70 58 64 100 94 90 77 102 88

2010 94 105 60 20 19 14

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103A 1925 to 2015 91 years Series 5

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

Lower 1974< -.035 1947> -.023 1972> -.013 1988> -.012 1994< -.011 1996> -.009 Higher 1936 .086 2010 .017

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

1936 -5.699 8 1

103A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1925 20 20 17 13 10

1930 10 17 21 32 107 63 0 42 65 80

1940 79 73 55 56 39 67 26 75 22 33

1950 23 57 22 37 66 61 61 78 71 55

1960 61 40 30 35 70 73 31 15 16 34

1970 50 45 85 117 47 138 163 233 216 219

1980 192 212 218 187 158 141 222 205 213 212

1990 183 149 154 189 156 152 181 182 176 213

2000 173 204 190 208 259 241 230 244 276 248

2010 126 232 353 261 210 91

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103B 1984 to 2015 32 years Series 6

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

Lower 2004< -.094 1988> -.055 2006> -.027 2000> -.026 1998< -.022 1990> -.010 Higher 2015 .082 2010 .054

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

2006 +3.1 SD

103B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1984 255 169 197 199 249 234

1990 292 254 212 299 283 206 129 168 188 278

2000 296 359 299 214 182 414 692 470 350 356

2010 172 289 375 215 216 92

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111A 1965 to 2015 51 years Series 7

[B] Entire series, effect on correlation ( .613) is:

Lower 1985> -.065 1993< -.024 1996> -.019 1997> -.013 1973> -.013 1967> -.010 Higher 2015 .041 1972 .039

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

1985 +3.5 SD; 1998 +3.4 SD

111A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1965 276 173 194 166 184

1970 174 157 124 175 178 216 181 215 208 144

1980 185 187 167 141 156 181 170 118 69 84

1990 84 83 75 67 56 65 77 89 134 109

2000 74 80 114 96 131 112 85 94 102 99

2010 67 89 125 159 195 68

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111B 1962 to 2015 54 years Series 8

[B] Entire series, effect on correlation ( .454) is:

Lower 1976< -.039 1989< -.021 1985> -.017 1994> -.017 1969> -.015 1968> -.013 Higher 1966 .029 1972 .026

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

1969 +3.5 SD

111B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1962 202 213 206 246 149 191 202 236

1970 212 191 157 173 183 211 147 181 190 156

1980 173 153 155 155 150 152 174 171 142 121

1990 131 120 147 143 153 109 113 100 117 94

2000 61 105 124 92 130 115 95 111 111 89

2010 78 99 127 133 165 47

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112A 1955 to 2015 61 years Series 9

[B] Entire series, effect on correlation ( .383) is:

Lower 2009< -.063 2010> -.054 1996> -.019 2003> -.015 1971> -.015 1958< -.009 Higher 1972 .053 1985 .039

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

2009 2010 5.5 SD

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

2009 -.036 26 2 >> WARNING: Ring is not usually narrow

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

1985 -4.7 SD; 2009 -6.7 SD

112A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1955 295 165 122 120 114

1960 155 191 144 144 134 99 82 65 68 125

1970 127 146 63 79 136 135 136 139 170 165

1980 164 255 214 216 174 41 148 127 110 128

1990 143 147 188 173 163 97 136 125 147 101

2000 99 121 141 241 246 181 164 175 166 0

2010 114 128 220 170 168 110

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112B 1959 to 2015 57 years Series 10

[B] Entire series, effect on correlation ( .347) is:

Lower 2009< -.091 2010> -.060 2003> -.013 2011< -.011 1965< -.011 1966> -.009 Higher 1972 .069 1985 .046

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

2009 2010 5.0 SD

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

2009 -.036 26 2 >> WARNING: Ring is not usually narrow

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

1985 -5.1 SD; 2009 -5.6 SD

112B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1959 185

1960 263 269 182 178 189 132 157 160 144 185

1970 224 241 52 177 294 301 381 344 320 295

1980 220 289 211 213 211 58 123 136 165 168

1990 209 228 244 252 241 186 169 162 182 168

2000 123 181 187 325 358 297 167 231 249 0

2010 117 84 120 103 115 84

113A 1967 to 2015 49 years Series 11

[B] Entire series, effect on correlation ( .350) is:

Lower 1986< -.177 1985> -.038 1988> -.023 1996> -.021 2000> -.020 1970> -.018 Higher 2010 .085 2015 .050

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

1985 1986 -4.8 SD

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

1986 -4.8 SD

113A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1967 119 70 96

1970 308 232 145 89 268 325 295 394 376 341

1980 296 241 222 182 158 185 90 134 141 114

1990 83 92 82 91 86 64 71 41 41 50

2000 65 62 69 94 127 121 127 184 183 165

2010 71 155 189 152 149 63

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113B 1961 to 2015 55 years Series 12

[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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1961 2010 -1 -.01 .00 -.13 -.14 -.01 .09 -.04 .19 .04 .32\* .22| .14 .17 .07 .10 -.03 - - - - -

1966 2015 0 -.02 -.01 -.13 -.17 -.07 .10 -.07 .12 -.04 .24 .26\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .274) is:

Lower 1986< -.141 1985> -.049 1993< -.042 1966> -.025 1991> -.015 1962> -.012 Higher 2000 .039 2012 .033

1961 to 2010 segment:

Lower 1986< -.147 1985> -.054 1993< -.045 1966> -.027 1991> -.016 1962> -.014 Higher 2000 .046 2004 .034

1966 to 2015 segment:

Lower 1986< -.148 1985> -.053 1993< -.043 1966> -.027 1991> -.016 1989< -.012 Higher 2000 .041 2012 .038

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

1985 1986 -4.4 SD

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

1985 +3.3 SD; 1994 -4.8 SD

113B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1961 266 195 153 200 178 188 147 91 93

1970 157 147 123 140 250 281 252 296 268 224

1980 225 155 157 181 183 204 86 134 120 89

1990 77 99 79 48 33 48 49 39 49 36

2000 19 30 42 54 66 50 25 59 62 48

2010 27 62 148 105 71 41

1094A 1917 to 2015 99 years Series 13

[B] Entire series, effect on correlation ( .726) is:

Lower 1957< -.024 1944> -.018 1918< -.017 2002< -.012 1945< -.012 1943< -.011 Higher 1936 .205 2010 .010

1094A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1917 294 244 267

1920 311 311 332 301 291 210 205 169 186 168

1930 146 195 171 150 198 206 73 121 116 127

1940 104 99 150 100 134 88 114 99 78 79

1950 92 97 93 104 126 130 118 57 118 93

1960 81 124 69 53 101 103 73 79 56 53

1970 75 62 58 227 484 457 275 325 203 152

1980 203 248 326 297 335 225 263 189 116 166

1990 203 195 197 234 158 115 109 129 97 77

2000 65 75 55 57 120 150 126 144 148 143

2010 65 164 194 168 236 116

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1094B 1919 to 2015 97 years Series 14

[B] Entire series, effect on correlation ( .708) is:

Lower 1988< -.033 1973> -.016 2007< -.007 2015> -.007 1990> -.007 1937< -.006 Higher 1936 .077 1934 .007

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

1973 +3.1 SD; 1988 -4.5 SD

1094B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 186

1920 202 254 261 226 220 215 177 181 173 149

1930 136 205 216 165 232 200 76 99 135 157

1940 133 129 130 97 91 74 77 47 48 57

1950 55 82 77 95 81 100 108 62 110 86

1960 68 66 39 31 70 70 40 43 25 38

1970 47 65 56 160 129 120 140 162 143 125

1980 167 201 252 206 218 144 182 164 90 169

1990 213 158 165 170 147 121 104 106 112 101

2000 91 123 95 78 133 117 90 67 84 69

2010 33 77 107 78 91 72

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1095A 1973 to 2015 43 years Series 15

[B] Entire series, effect on correlation ( .567) is:

Lower 1973< -.075 2012< -.038 1988> -.022 2006> -.020 1985> -.012 2009> -.011 Higher 2010 .071 1996 .031

1095A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 56 226 344 334 355 278 222

1980 306 325 312 314 277 243 325 278 242 303

1990 261 173 177 238 194 157 114 99 138 175

2000 139 121 131 112 148 134 179 145 147 134

2010 36 48 55 66 127 62

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1095B 1973 to 2015 43 years Series 16

[B] Entire series, effect on correlation ( .435) is:

Lower 2004< -.049 1988> -.044 2015> -.034 2000> -.016 1984< -.014 2011< -.012 Higher 2010 .059 1985 .038

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

1985 -6.5 SD

1095B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 159 387 432 354 378 307 312

1980 345 319 308 260 207 136 248 250 262 293

1990 195 195 182 190 164 129 140 146 153 174

2000 143 165 158 110 87 156 124 98 119 66

2010 18 27 55 54 98 58

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1096A 1974 to 2015 42 years Series 17

[B] Entire series, effect on correlation ( .466) is:

Lower 1990< -.200 1988> -.026 1981< -.016 1995> -.016 2006> -.013 2003> -.010 Higher 2010 .088 2004 .037

1096A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1974 383 485 499 378 313 228

1980 256 232 269 287 304 199 189 163 197 194

1990 111 106 139 217 200 195 129 156 185 224

2000 186 210 213 244 321 255 277 177 250 211

2010 127 281 382 243 291 104

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1096B 1942 to 2015 74 years Series 18

[B] Entire series, effect on correlation ( .513) is:

Lower 1947> -.061 1953< -.031 1986< -.025 1988> -.020 2007< -.017 2008< -.013 Higher 1972 .032 2010 .027

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

1947 +4.3 SD

1096B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1942 91 76 83 71 27 126 33 26

1950 22 32 11 9 69 66 35 72 92 50

1960 41 103 35 97 156 122 60 93 129 132

1970 143 107 86 224 340 393 354 382 361 317

1980 321 258 275 323 344 260 240 292 305 330

1990 277 294 250 326 293 269 255 212 257 249

2000 178 194 254 218 336 293 245 147 139 197

2010 109 316 404 218 275 125

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1097A 1973 to 2015 43 years Series 19

[B] Entire series, effect on correlation ( .551) is:

Lower 2000> -.056 1988> -.034 1991> -.025 1981< -.023 1983< -.017 1996> -.017 Higher 2015 .067 2010 .064

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

2002 +3.3 SD

1097A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 238 421 327 294 306 315 291

1980 300 247 271 230 232 220 261 245 251 260

1990 233 256 227 264 201 200 209 171 217 251

2000 246 255 310 231 269 242 217 204 199 193

2010 131 186 220 214 236 97

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1097B 1980 to 2015 36 years Series 20

[B] Entire series, effect on correlation ( .476) is:

Lower 2007< -.031 2000> -.031 1996> -.028 1984< -.027 1995> -.026 1997< -.025 Higher 2010 .142 2014 .021

1097B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1980 263 244 259 194 177 199 253 248 189 201

1990 187 185 165 246 216 208 192 129 174 225

2000 187 199 210 152 196 168 139 114 145 130

2010 80 172 200 188 249 150

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1098A 1973 to 2015 43 years Series 21

[B] Entire series, effect on correlation ( .438) is:

Lower 1984< -.086 1996> -.044 1991> -.034 1997> -.026 2006< -.014 1994> -.014 Higher 2015 .040 2010 .035

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

1984 -5.1 SD

1098A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 133 334 394 407 393 336 254

1980 277 277 226 189 145 160 238 238 188 235

1990 235 259 263 239 242 207 217 224 227 223

2000 188 182 206 159 189 157 108 131 133 103

2010 67 125 216 167 183 83

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1098B 1957 to 2015 59 years Series 22

[B] Entire series, effect on correlation ( .463) is:

Lower 2006< -.068 2010> -.036 1972> -.020 1997> -.020 1962> -.016 2001< -.014 Higher 2015 .046 2000 .034

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

2006 -5.0 SD

1098B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 98 88 53

1960 54 28 61 15 26 59 40 48 42 36

1970 37 71 111 185 281 369 402 413 438 364

1980 274 256 254 250 238 221 330 327 228 252

1990 291 293 319 356 302 247 230 260 258 232

2000 178 169 180 161 230 185 127 165 164 151

2010 135 119 143 88 181 87

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1099A 1956 to 2015 60 years Series 23

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

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1966 2015 0 -.19 -.05 .09 -.02 .01 -.18 .08 -.19 -.10 .21 .26\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .203) is:

Lower 2015> -.089 2000> -.046 2014< -.038 1958< -.029 1993< -.025 1988> -.020 Higher 1996 .065 1985 .056

1966 to 2015 segment:

Lower 2015> -.103 2000> -.053 2014< -.047 1993< -.031 1988> -.022 2013> -.010 Higher 1996 .055 1985 .054

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

1996 -5.6 SD; 2015 +3.2 SD

1099A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1956 512 377 258 318

1960 225 207 154 128 95 70 28 16 7 6

1970 7 12 4 51 264 409 293 391 343 258

1980 246 299 410 416 454 276 361 308 319 294

1990 320 272 228 184 149 138 85 100 115 99

2000 140 130 131 99 122 152 129 92 74 37

2010 6 7 13 57 13 25

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1099B 1933 to 2015 83 years Series 24

[B] Entire series, effect on correlation ( .543) is:

Lower 1944< -.059 1941> -.020 1948> -.011 1942< -.011 1950< -.009 2011< -.009 Higher 1936 .072 2010 .020

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

1935 1936 5.1 SD

[D] 3 Absent rings: Year Master N series Absent

1967 -.914 19 1

1968 -1.359 19 1

1969 -.887 19 1

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

1936 +7.3 SD

1099B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 24 65 50 45 68 52 66

1940 50 111 70 122 40 89 50 85 83 90

1950 36 82 111 172 284 260 220 292 205 160

1960 180 205 189 157 112 91 42 0 0 0

1970 16 18 31 95 216 415 426 438 320 294

1980 246 266 317 297 322 229 292 234 198 205

1990 207 173 196 226 190 162 117 114 132 148

2000 158 174 211 224 254 175 226 188 196 141

2010 35 11 25 18 12 8

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1448A 1952 to 2015 64 years Series 25

[B] Entire series, effect on correlation ( .504) is:

Lower 1988< -.027 1997> -.023 1985> -.018 1973> -.013 1995> -.011 2000> -.011 Higher 2010 .039 2004 .019

1448A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1952 95 110 165 232 247 242 215 229

1960 187 204 152 181 164 139 114 132 80 92

1970 79 77 59 131 133 239 241 296 250 187

1980 237 231 220 247 360 334 394 419 261 292

1990 277 232 252 243 216 236 212 256 274 277

2000 252 267 274 248 291 219 187 176 144 108

2010 44 59 79 124 212 116

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1448B 1960 to 2015 56 years Series 26

[B] Entire series, effect on correlation ( .457) is:

Lower 2003< -.041 1985> -.031 2010> -.030 1974< -.025 1961< -.017 1988> -.015 Higher 2004 .039 2015 .035

1448B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1960 356 236 220 173 172 162 142 105 118 84

1970 84 66 58 49 56 127 175 285 289 258

1980 260 243 235 220 309 278 246 220 215 286

1990 240 170 179 194 164 136 104 108 127 106

2000 91 98 93 58 139 92 90 104 81 44

2010 49 47 117 80 121 51

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PART 7: DESCRIPTIVE STATISTICS: FAGR\_MMRB1400A\_Corr6-50 11:57 Tue 20 Dec 2016 Page 6

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Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

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1 101A 1894 2015 122 5 0 .720 1.19 2.71 .598 .752 .310 2.47 .311 -.022 1

2 101B 1898 2015 118 5 0 .733 1.43 3.64 .817 .809 .301 2.48 .330 -.024 1

3 102A 1922 2015 94 4 0 .730 1.26 3.37 .907 .900 .307 2.52 .296 -.009 1

4 102B 1913 2015 103 4 1 .725 1.02 2.96 .733 .916 .278 2.30 .257 -.050 1

5 103A 1925 2015 91 3 0 .622 1.16 3.53 .853 .889 .344 2.74 .490 -.021 1

6 103B 1984 2015 32 1 0 .514 2.69 6.92 1.136 .541 .291 2.81 .668 -.030 2

7 111A 1965 2015 51 2 0 .613 1.32 2.76 .517 .745 .205 2.69 .629 -.043 1

8 111B 1962 2015 54 2 0 .454 1.46 2.46 .439 .721 .175 2.38 .416 -.005 1

9 112A 1955 2015 61 2 0 .383 1.44 2.95 .512 .436 .292 2.47 .427 -.040 1

10 112B 1959 2015 57 2 0 .347 1.97 3.81 .793 .599 .309 2.37 .391 -.089 1

11 113A 1967 2015 49 1 0 .350 1.53 3.93 .926 .795 .278 2.49 .446 -.072 1

12 113B 1961 2015 55 2 2 .274 1.21 2.96 .779 .874 .298 2.62 .435 -.020 2

13 1094A 1917 2015 99 4 0 .726 1.60 4.84 .887 .794 .255 2.44 .321 -.065 1

14 1094B 1919 2015 97 4 0 .708 1.22 2.61 .587 .830 .239 2.53 .424 .003 1

15 1095A 1973 2015 43 1 0 .567 1.92 3.55 .934 .824 .254 2.57 .516 .118 2

16 1095B 1973 2015 43 1 0 .435 1.90 4.32 1.045 .862 .250 2.46 .437 .077 1

17 1096A 1974 2015 42 1 0 .466 2.38 4.99 .909 .684 .240 2.51 .443 .087 3

18 1096B 1942 2015 74 3 0 .513 1.88 4.04 1.145 .848 .348 2.86 .642 .011 1

19 1097A 1973 2015 43 1 0 .551 2.42 4.21 .536 .533 .146 2.72 .652 .001 2

20 1097B 1980 2015 36 1 0 .476 1.90 2.63 .430 .472 .199 2.57 .588 .018 1

21 1098A 1973 2015 43 1 0 .438 2.13 4.07 .787 .779 .194 2.58 .621 .045 1

22 1098B 1957 2015 59 2 0 .463 1.90 4.38 1.125 .918 .249 2.77 .537 -.033 1

23 1099A 1956 2015 60 2 1 .203 1.79 5.12 1.385 .891 .380 2.77 .452 -.087 1

24 1099B 1933 2015 83 3 0 .543 1.51 4.38 1.059 .887 .358 2.69 .503 -.029 3

25 1448A 1952 2015 64 2 0 .504 2.02 4.19 .824 .839 .200 2.52 .403 -.086 1

26 1448B 1960 2015 56 2 0 .457 1.54 3.56 .811 .865 .225 2.89 .590 -.030 1

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Total or mean: 1729 61 4 .558 1.57 6.92 .821 .792 .276 2.89 .440 -.021

- = [ COFECHA FAGR COF ] = -