[] Dendrochronology Program Library Run PIRU Program COF 08:46 Tue 02 Jan 2018 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30319

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: PIRU\_MANSFIELD\_CORR1-50

File of DATED series: PIRU\_MANSFIELD\_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 1781 to 2017 237 years

Continuous time span is 1781 to 2017 237 years

Portion with two or more series is 1781 to 2017 237 years

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

\*C\* Number of dated series 36 \*C\*

\*O\* Master series 1781 2017 237 yrs \*O\*

\*F\* Total rings in all series 4506 \*F\*

\*E\* Total dated rings checked 4506 \*E\*

\*C\* Series intercorrelation .564 \*C\*

\*H\* Average mean sensitivity .236 \*H\*

\*A\* Segments, possible problems 18 \*A\*

\*\*\* Mean length of series 125.2 \*\*\*

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

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

5A 2 absent rings: 1966 1967

2 absent rings .044%

1800 -.388 2 1850 -.389 7 1900 1.199 17 1950 -.351 31 2000 -.785 36

1801 1.713 2 1851 .917 8 1901 .732 18 1951 .156 32 2001 .504 36

1802 .291 2 1852 -.076 8 1902 .433 18 1952 .586 32 2002 .755 36

1803 .537 2 1853 .079 8 1903 .316 20 1953 .345 33 2003 -.599 36

1804 -1.215 2 1854 -.012 8 1904 1.484 21 1954 .529 34 2004 -2.504 36

1805 1.048 2 1855 .578 8 1905 1.240 21 1955 1.645 34 2005 -1.958 36

1806 .435 2 1856 .985 8 1906 .541 21 1956 -1.057 34 2006 -.796 36

1807 3.227 2 1857 .464 8 1907 .233 21 1957 .987 34 2007 .852 36

1808 .796 2 1858 1.046 10 1908 .536 21 1958 1.643 34 2008 .394 36

1809 -3.757 2 1859 .615 12 1909 -.549 22 1959 .084 34 2009 1.699 36

1810 -.384 2 1860 .983 12 1910 .781 22 1960 -.326 34 2010 .750 36

1811 1.705 4 1861 .345 14 1911 -2.325 22 1961 .661 34 2011 .235 36

1812 -.826 4 1862 .260 14 1912 -.168 22 1962 -.145 34 2012 1.488 36

1813 -1.197 4 1863 .247 14 1913 .627 22 1963 -.546 34 2013 .540 36

1814 -1.854 4 1864 -.615 14 1914 -.008 22 1964 -.339 34 2014 .707 36

1815 .516 4 1865 -.232 14 1915 -.350 22 1965 -.710 34 2015 -1.161 36

1816 1.188 4 1866 .044 14 1916 .771 22 1966 -.807 34 1 2016 .382 36

1817 1.420 4 1867 .840 14 1917 -.868 22 1967 -.622 34 1 2017 -1.259 36

1818 -.315 4 1868 -.439 14 1918 -1.632 22 1968 -.582 34

1819 .645 4 1869 -.653 14 1919 -.521 22 1969 -.060 34

1820 .110 4 1870 .256 14 1920 -.395 22 1970 1.164 34

1821 -.092 4 1871 -.051 14 1921 .507 22 1971 1.347 34

1822 .126 4 1872 -.269 15 1922 -.151 23 1972 .058 34

1823 -.446 4 1873 -.598 15 1923 -.374 24 1973 .470 34

1824 .005 4 1874 -.201 15 1924 1.413 24 1974 -1.126 34

1825 1.518 5 1875 -.026 15 1925 -1.384 24 1975 -.784 34

1826 -.260 5 1876 -1.052 15 1926 .896 24 1976 -1.738 34

1827 -.839 5 1877 -1.188 15 1927 .832 24 1977 -2.168 34

1828 -1.609 5 1878 -.424 15 1928 .800 24 1978 -.103 34

1829 -.522 5 1879 -.245 15 1929 -.025 24 1979 .539 34

1830 .367 5 1880 1.274 15 1930 -.210 24 1980 .993 34

1781 -.412 2 1831 -.549 5 1881 .054 15 1931 .083 26 1981 -.062 34

1782 .638 2 1832 -2.157 5 1882 -.630 15 1932 .439 27 1982 .632 34

1783 -2.163 2 1833 .620 5 1883 -.449 15 1933 -.476 27 1983 .220 34

1784 1.417 2 1834 1.279 5 1884 .216 15 1934 .835 27 1984 -.439 34

1785 .837 2 1835 1.028 5 1885 -.376 15 1935 -3.172 27 1985 -.336 34

1786 2.411 2 1836 .658 5 1886 1.404 15 1936 -1.774 27 1986 -.948 34

1787 2.163 2 1837 -.523 5 1887 -.454 15 1937 -1.385 27 1987 .816 35

1788 .280 2 1838 -1.132 5 1888 .264 15 1938 .413 28 1988 .203 35

1789 -.741 2 1839 -.714 5 1889 .249 15 1939 .155 28 1989 .156 35

1790 -1.349 2 1840 .743 5 1890 .092 15 1940 -1.291 28 1990 .559 36

1791 .166 2 1841 .226 5 1891 -.362 15 1941 1.058 28 1991 .994 36

1792 -.952 2 1842 -.230 5 1892 -.081 15 1942 .174 28 1992 1.315 36

1793 -.446 2 1843 -.353 5 1893 -2.158 17 1943 -.011 29 1993 1.763 36

1794 -2.477 2 1844 -1.256 5 1894 -.976 17 1944 .088 29 1994 .562 36

1795 -1.422 2 1845 -.106 5 1895 -1.236 17 1945 .716 30 1995 .741 36

1796 .519 2 1846 1.202 5 1896 -.898 17 1946 .449 30 1996 -1.770 36

1797 1.827 2 1847 -.625 5 1897 -.471 17 1947 .817 30 1997 -1.267 36

1798 -.283 2 1848 .747 5 1898 .570 17 1948 -1.783 30 1998 -.426 36

1799 -.785 2 1849 -.721 7 1899 .736 17 1949 .707 30 1999 .617 36

PART 5: CORRELATION OF SERIES BY SEGMENTS: PIRU\_MANSFIELD\_CORR1-50 08:46 Tue 02 Jan 2018 Page 5

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Correlations of 50-year dated segments, lagged 25 years

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

Seq Series Time\_span 1775 1800 1825 1850 1875 1900 1925 1950 1975

1824 1849 1874 1899 1924 1949 1974 1999 2024

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

1 1A 1904 2017 .43 .63 .68 .67

2 1B 1909 2017 .43 .45 .67 .70

3 2A 1931 2017 .62 .49 .57

4 2B 1931 2017 .69 .49 .65

5 3A 1861 2017 .47 .60 .74 .74 .70 .64

6 3B 1861 2017 .54 .75 .81 .68 .40 .44

7 4A 1858 2017 .41 .75 .72 .67 .71 .59

8 4B 1825 2017 -.18B .12B .52 .74 .73 .66 .65

9 5A 1922 2017 .65 .65 .26A .33A

10 5B 1923 2017 .59 .62 .38 .34

11 6A 1859 2017 .44 .57 .56 .61 .57 .74

12 6B 1859 2017 .67 .71 .57 .49 .56 .59

13 7A 1781 2017 .69 .66 .30A .24B .52 .62 .58 .51 .35

14 7B 1781 2017 .66 .52 .23B .25B .39 .42 .42 .50 .67

15 8A 1872 2017 .37 .39 .61 .66 .60 .66

16 8B 1901 2017 .55 .60 .55 .67

17 9A 1943 2017 .33 .48 .66

18 9B 1938 2017 .47 .61 .70

19 10A 1849 2017 .33A .41 .59 .76 .80 .65 .74

20 10B 1858 2017 .33 .54 .60 .54 .60 .70

21 11A 1945 2017 .68 .67 .84

22 11B 1950 2017 .65 .70

23 12A 1893 2017 .22B .20B .40 .62 .58

24 12B 1893 2017 .30A .42 .45 .56 .67

25 13A 1932 2017 .37 .43 .57

26 13B 1951 2017 .51 .50

27 14A 1903 2017 .51 .69 .58 .69

28 14B 1903 2017 .69 .81 .74 .68

29 15A 1987 2017 .53

30 15B 1990 2017 .51

31 16A 1811 2017 .48 .33A .31A .52 .78 .83 .76 .75

32 16B 1811 2017 .39 .24A .40 .61 .70 .62 .50 .70

33 17A 1851 2017 .20B .38 .74 .75 .53 .72

34 17B 1849 2017 .27A .27A .63 .73 .75 .67 .74

35 18A 1954 2017 .57 .44

36 18B 1953 2017 .52 .54

Av segment correlation .68 .51 .22 .36 .53 .61 .61 .57 .62

PART 6: POTENTIAL PROBLEMS: PIRU\_MANSFIELD\_CORR1-50 08:46 Tue 02 Jan 2018 Page 5

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

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

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

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

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

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

[D] Absent rings (zero values)

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

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1A 1904 to 2017 114 years Series 1

[B] Entire series, effect on correlation ( .541) is:

Lower 1918< -.028 1925> -.018 1904< -.017 1917> -.015 1907> -.011 1929> -.010 Higher 1935 .025 1956 .019

1A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 74 127 99 200 120 102

1910 141 102 129 110 116 138 170 184 87 126

1920 161 213 214 229 239 220 232 212 217 305

1930 253 234 312 305 367 207 208 241 319 271

1940 231 331 240 246 325 393 323 333 273 309

1950 290 285 326 284 305 365 236 288 303 297

1960 285 289 183 222 193 211 213 238 296 339

1970 345 338 256 278 199 196 165 154 189 243

1980 230 148 184 152 158 228 156 215 172 189

1990 224 133 155 195 158 147 74 86 72 94

2000 56 96 126 150 87 143 125 162 154 196

2010 225 151 185 121 144 85 131 83

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1B 1909 to 2017 109 years Series 2

[B] Entire series, effect on correlation ( .495) is:

Lower 1918< -.038 1948> -.022 1928< -.020 1925> -.011 1909> -.009 1933> -.009 Higher 1956 .025 1996 .016

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

1917 1918 -4.0 SD

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

1918 -5.1 SD

1B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 75

1910 89 46 99 115 112 115 121 133 35 87

1920 155 183 153 200 232 212 250 207 170 274

1930 251 278 394 429 527 336 326 317 409 425

1940 384 415 370 387 373 460 395 458 440 453

1950 465 367 478 375 357 455 276 346 398 320

1960 254 258 199 241 266 289 298 212 211 195

1970 250 222 149 182 105 157 114 85 107 122

1980 207 176 230 210 237 227 143 198 180 183

1990 200 199 202 204 151 146 70 82 74 106

2000 53 79 108 119 99 144 119 217 215 195

2010 222 178 231 148 164 94 127 95

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2A 1931 to 2017 87 years Series 3

[B] Entire series, effect on correlation ( .591) is:

Lower 1948> -.027 1946< -.023 1977> -.011 2015> -.009 1936> -.009 1992< -.008 Higher 1935 .110 2004 .009

2A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 70 108 141 216 75 188 193 194 157

1940 168 269 327 253 281 384 205 675 376 368

1950 357 276 354 375 336 500 302 518 465 351

1960 321 293 207 213 186 139 136 158 336 433

1970 474 432 242 319 149 169 141 221 210 232

1980 220 187 264 256 224 206 106 171 180 140

1990 122 123 118 122 117 192 107 96 92 131

2000 79 151 190 108 90 96 259 305 200 201

2010 156 188 324 225 260 230 259 151

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2B 1931 to 2017 87 years Series 4

[B] Entire series, effect on correlation ( .691) is:

Lower 1948> -.024 1996> -.020 1977> -.014 1936> -.011 1939< -.009 1953< -.008 Higher 1935 .102 2004 .016

2B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 86 110 107 190 94 161 162 234 173

1940 162 259 202 192 275 398 447 468 379 367

1950 332 387 434 325 334 437 342 340 341 278

1960 238 355 306 277 333 367 285 239 294 476

1970 484 460 246 212 186 193 185 237 337 307

1980 250 232 205 167 137 146 136 223 270 244

1990 266 253 255 234 272 240 194 159 143 165

2000 95 110 179 119 52 75 139 235 220 216

2010 141 146 156 125 150 97 108 73

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3A 1861 to 2017 157 years Series 5

[B] Entire series, effect on correlation ( .635) is:

Lower 1925> -.021 2015> -.017 1873< -.015 1877> -.012 1884< -.010 1984> -.007 Higher 1948 .018 1893 .015

3A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1861 104 147 153 128 114 113 121 88 84

1870 85 99 100 66 93 90 70 112 128 136

1880 114 128 86 113 86 97 148 92 135 170

1890 196 185 206 123 125 152 136 168 179 176

1900 169 172 177 193 266 278 245 188 190 170

1910 178 118 159 213 147 140 140 123 108 120

1920 114 132 112 124 226 204 267 308 273 212

1930 206 243 234 155 201 111 120 113 177 170

1940 122 176 171 156 152 156 130 140 93 118

1950 106 129 145 117 155 158 116 163 189 144

1960 140 172 165 132 129 102 73 98 112 129

1970 125 150 119 121 91 68 64 41 62 98

1980 126 138 104 122 160 130 114 154 136 171

1990 174 160 185 178 144 174 103 109 121 108

2000 90 117 128 86 69 68 88 97 115 201

2010 139 141 131 115 181 211 170 109

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3B 1861 to 2017 157 years Series 6

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

Lower 1966< -.035 1984> -.011 1884< -.009 1986> -.008 2015> -.008 1936> -.008 Higher 1935 .030 1911 .022

3B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1861 111 122 142 119 112 110 99 63 67

1870 78 87 86 98 141 136 88 96 114 153

1880 155 143 108 146 108 121 158 122 116 137

1890 146 147 198 122 124 124 172 154 212 244

1900 306 218 209 220 275 191 151 159 221 189

1910 220 112 148 171 126 112 140 88 58 88

1920 120 126 116 129 209 131 139 151 158 123

1930 123 192 221 158 249 133 184 151 200 173

1940 123 196 196 139 160 161 128 130 85 162

1950 118 132 167 130 160 200 120 198 230 166

1960 133 153 143 126 96 78 20 41 41 69

1970 77 102 80 86 87 80 59 75 82 89

1980 106 112 105 119 178 159 171 173 129 145

1990 138 136 147 131 117 74 61 73 64 63

2000 35 43 52 54 29 27 57 78 83 124

2010 108 140 166 214 182 184 181 176

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4A 1858 to 2017 160 years Series 7

[B] Entire series, effect on correlation ( .627) is:

Lower 1925> -.014 2012< -.012 2007< -.009 1972> -.009 2011> -.008 1966> -.007 Higher 1911 .018 1956 .013

4A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1858 73 73

1860 137 98 70 46 25 20 25 21 25 24

1870 11 7 3 11 5 9 9 6 10 10

1880 23 25 37 47 61 64 112 95 109 120

1890 119 80 85 54 83 100 142 156 137 167

1900 187 199 185 178 226 276 257 247 223 151

1910 188 123 181 210 162 182 222 179 132 164

1920 173 204 205 259 296 226 232 257 216 173

1930 132 158 142 98 115 56 60 59 88 84

1940 72 94 80 87 141 146 167 160 48 108

1950 99 112 145 115 120 144 82 115 141 125

1960 116 108 86 77 92 99 136 98 82 83

1970 97 150 184 189 111 90 72 57 106 104

1980 132 138 178 132 104 100 94 109 129 94

1990 101 107 148 151 132 117 76 93 101 144

2000 86 131 131 110 78 88 116 99 139 209

2010 126 203 141 153 178 109 99 102

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4B 1825 to 2017 193 years Series 8

[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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1825 1874 -1 -.02 -.03 -.06 -.04 .06 -.26 .14 -.10 -.16 .44\*-.18| .16 .22 -.26 .09 .25 .00 -.04 .07 .01 -.22

1850 1899 4 -.12 -.23 .13 -.11 .11 -.19 .06 -.10 .28 -.11 .12| .01 .12 .14 .48\*-.11 .24 -.24 .00 -.27 -.14

[B] Entire series, effect on correlation ( .442) is:

Lower 1828> -.032 1889< -.027 1847> -.025 1848< -.021 1830< -.009 1870< -.009 Higher 1935 .056 1911 .040

1825 to 1874 segment:

Lower 1828> -.092 1847> -.069 1848< -.056 1830< -.023 1849> -.017 1870< -.016 Higher 1825 .044 1834 .041

1850 to 1899 segment:

Lower 1889< -.095 1870< -.033 1887> -.030 1869> -.022 1876> -.018 1850> -.017 Higher 1886 .089 1880 .032

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

1827 1828 4.0 SD 1847 1848 -4.3 SD

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

1828 +4.3 SD; 1847 +3.5 SD

4B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1825 109 81 60 114 64

1830 48 69 61 62 95 71 54 55 37 36

1840 40 49 37 35 38 30 53 68 35 45

1850 52 48 48 28 35 38 54 46 40 42

1860 30 21 23 22 12 9 15 18 16 17

1870 8 6 5 9 11 11 15 16 19 14

1880 27 19 23 33 39 44 79 66 75 30

1890 38 45 63 62 72 68 71 82 87 92

1900 107 108 106 100 136 130 105 106 108 118

1910 136 81 109 120 110 96 99 92 90 78

1920 83 95 64 72 121 85 133 143 104 65

1930 77 85 90 90 110 50 79 78 137 119

1940 104 147 171 147 181 220 188 182 175 249

1950 181 295 309 293 248 279 176 221 272 216

1960 200 225 191 149 132 149 138 89 109 97

1970 145 168 136 170 134 165 133 118 189 222

1980 209 189 236 173 116 145 137 143 134 119

1990 146 128 197 234 200 205 92 69 49 107

2000 96 110 86 98 69 112 148 226 219 317

2010 180 190 162 172 170 111 121 100

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5A 1922 to 2017 96 years Series 9

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

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1950 1999 0 -.10 -.01 .00 -.01 .17 -.10 .19 -.09 -.01 -.23 .26\*-.18 .08 .11 .20 -.17 .11 .07 .11 -.07 .07

1968 2017 0 .03 -.08 -.06 .02 .03 -.04 .15 -.01 -.03 -.17 .33\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .559) is:

Lower 1956> -.022 1976> -.016 1970< -.015 1952< -.013 1974> -.013 1971< -.011 Higher 1935 .144 1925 .021

1950 to 1999 segment:

Lower 1956> -.042 1976> -.040 1970< -.039 1952< -.035 1974> -.029 1971< -.028 Higher 1955 .035 1987 .033

1968 to 2017 segment:

Lower 1976> -.037 1970< -.036 1974> -.028 1971< -.026 2008< -.026 2016< -.021 Higher 2009 .047 2012 .034

[D] 2 Absent rings: Year Master N series Absent

1966 -.807 34 1

1967 -.622 34 1

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

1935 -5.2 SD

5A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1922 98 91 94 66 116 119 121 135

1930 113 101 119 117 134 46 123 116 264 236

1940 204 195 197 217 199 217 291 267 207 229

1950 194 235 165 250 262 336 288 336 337 233

1960 179 209 110 90 115 126 0 0 12 9

1970 14 24 64 275 290 380 387 311 321 255

1980 275 248 280 289 308 386 345 462 375 418

1990 414 451 419 371 294 263 245 211 283 442

2000 299 375 347 227 187 196 204 220 139 326

2010 202 271 337 297 203 165 135 152

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5B 1923 to 2017 95 years Series 10

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

Lower 1941< -.025 1993< -.020 2014< -.018 1923> -.011 1987< -.010 1977> -.009 Higher 1935 .171 1949 .008

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

1935 -4.9 SD

5B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1923 110 95 80 105 104 95 98

1930 82 83 102 66 101 34 83 120 179 159

1940 143 122 115 153 195 194 231 234 217 297

1950 312 319 260 286 311 334 271 262 233 172

1960 174 225 146 163 186 136 48 92 249 368

1970 413 355 287 247 204 192 202 238 316 405

1980 375 294 317 256 200 206 172 191 231 284

1990 374 383 417 352 417 449 386 362 435 398

2000 434 404 447 492 425 338 333 537 648 673

2010 666 697 587 504 235 245 320 274

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6A 1859 to 2017 159 years Series 11

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

Lower 1869> -.015 1935> -.013 1959< -.010 1862> -.009 1933< -.008 1981> -.007 Higher 1925 .024 1893 .020

6A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1859 199

1860 174 140 259 166 111 145 93 75 80 144

1870 110 62 52 39 29 33 28 24 35 42

1880 43 41 38 37 53 51 78 44 57 82

1890 59 64 53 22 27 48 35 40 53 66

1900 81 77 145 81 104 93 105 134 146 117

1910 129 71 108 110 54 38 33 17 23 24

1920 16 23 39 24 30 12 28 20 21 19

1930 27 23 28 15 23 24 35 39 93 101

1940 98 119 167 169 159 207 206 190 136 161

1950 167 203 209 212 253 250 207 274 259 183

1960 227 228 192 174 202 220 226 214 203 279

1970 389 337 231 294 162 177 144 164 269 339

1980 412 469 482 320 280 248 178 219 180 214

1990 261 203 189 243 188 183 160 177 197 228

2000 201 243 268 195 117 144 130 221 223 238

2010 186 137 191 141 126 88 130 95

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6B 1859 to 2017 159 years Series 12

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

Lower 1948> -.017 1934< -.017 2011< -.011 1909> -.009 1956> -.009 2015> -.008 Higher 1911 .015 1893 .010

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

1893 -4.6 SD

6B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1859 200

1860 167 174 125 139 96 100 117 94 52 51

1870 40 38 57 36 38 28 19 19 23 20

1880 23 14 15 14 19 16 29 18 24 28

1890 29 34 34 16 26 34 48 52 72 75

1900 70 86 102 98 139 105 108 125 113 131

1910 167 85 135 117 97 80 84 54 50 58

1920 41 51 46 40 64 30 41 36 43 34

1930 27 17 19 17 9 6 16 23 40 71

1940 91 145 141 134 160 169 190 181 187 222

1950 198 199 199 211 286 240 228 273 331 217

1960 219 227 251 214 240 247 257 169 187 166

1970 320 313 230 343 195 215 159 175 313 354

1980 368 406 481 352 270 303 250 333 268 290

1990 301 299 325 435 377 358 285 240 252 250

2000 347 490 433 383 289 303 358 457 346 466

2010 346 247 395 334 388 375 355 317

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7A 1781 to 2017 237 years Series 13

[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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1825 1874 0 .01 -.07 -.01 -.18 .09 .26 .08 -.01 -.06 .11 .30\*-.16 -.14 .11 .04 .08 -.24 -.14 .03 .04 .21

1850 1899 -3 -.17 -.16 .17 -.10 .02 .14 .16 .27\* .03 .20 .24|-.11 .00 -.04 -.20 .00 -.23 -.21 -.12 -.09 -.15

[B] Entire series, effect on correlation ( .503) is:

Lower 1792> -.012 2006< -.011 1887> -.007 2011< -.007 1829< -.007 2004> -.007 Higher 1809 .031 1807 .012

1825 to 1874 segment:

Lower 1838> -.041 1829< -.032 1843> -.031 1866< -.028 1858< -.024 1826> -.021 Higher 1832 .047 1825 .041

1850 to 1899 segment:

Lower 1887> -.052 1866< -.029 1858< -.024 1860< -.022 1853> -.019 1871> -.017 Higher 1886 .050 1876 .045

7A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1781 108 120 92 135 126 155 145 100 84

1790 69 90 88 70 48 49 83 77 48 40

1800 47 60 43 40 19 33 23 52 28 5

1810 15 22 9 10 7 13 14 16 14 26

1820 21 18 19 20 27 53 42 29 19 19

1830 45 39 32 82 75 85 94 92 112 94

1840 159 129 89 140 109 151 178 108 141 65

1850 60 94 73 143 130 126 150 128 94 137

1860 92 133 124 103 99 70 50 91 57 43

1870 76 89 52 59 46 72 43 48 57 52

1880 60 63 52 62 70 66 91 84 95 101

1890 85 70 74 51 53 33 31 33 58 83

1900 133 140 109 130 119 127 139 139 207 101

1910 181 91 84 88 127 108 202 86 137 172

1920 121 213 117 158 300 141 198 215 289 187

1930 156 187 128 126 188 112 100 121 107 140

1940 104 190 89 91 118 182 152 204 121 234

1950 134 119 133 95 127 207 160 218 272 288

1960 281 307 279 233 230 184 147 148 200 190

1970 248 233 188 190 99 93 48 45 66 83

1980 82 76 77 84 72 108 109 158 118 93

1990 108 146 125 141 132 184 129 155 209 224

2000 203 287 250 248 199 199 71 135 198 262

2010 229 79 102 102 154 125 193 178

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7B 1781 to 2017 237 years Series 14

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

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

1825 1874 -5 .08 -.09 -.02 -.16 .07 .26\* .15 .02 -.05 .01 .23|-.06 -.23 -.11 -.17 .02 -.02 -.03 -.09 -.03 .14

1850 1899 -8 .03 -.27 .26\* .03 .12 .07 .18 .16 .14 -.01 .25|-.05 .00 -.23 -.12 -.11 -.20 -.22 -.07 -.09 -.07

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

Lower 1935> -.015 1851< -.012 1917< -.010 1860< -.009 1792< -.007 1909< -.007 Higher 1809 .015 1925 .012

1825 to 1874 segment:

Lower 1851< -.074 1860< -.053 1847> -.028 1873> -.020 1829< -.018 1864> -.015 Higher 1832 .039 1828 .033

1850 to 1899 segment:

Lower 1851< -.085 1860< -.062 1887> -.030 1873> -.023 1891> -.019 1864> -.017 Higher 1893 .068 1876 .049

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

1832 -6.0 SD

7B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1781 193 203 133 188 158 183 164 121 95

1790 85 86 55 68 46 52 50 76 48 40

1800 34 55 36 37 30 43 41 58 30 10

1810 22 30 21 17 17 27 31 28 17 25

1820 20 13 13 18 14 22 21 22 16 16

1830 29 20 12 34 49 52 59 51 58 75

1840 115 92 62 82 84 131 117 102 141 79

1850 70 44 38 65 68 89 121 107 129 100

1860 55 77 74 85 78 61 54 73 44 38

1870 57 51 24 38 28 26 10 15 15 15

1880 24 23 18 18 29 23 26 24 29 26

1890 33 33 34 20 27 18 21 30 26 26

1900 47 45 31 46 36 48 43 33 56 30

1910 53 53 64 71 83 69 96 43 69 94

1920 85 99 89 82 157 75 103 111 115 84

1930 83 170 157 124 137 102 63 81 84 77

1940 60 115 66 59 174 169 121 107 57 172

1950 137 157 147 67 56 98 94 127 109 101

1960 96 165 140 169 180 199 119 113 77 78

1970 130 103 69 45 42 44 33 18 46 43

1980 57 42 44 49 32 52 53 90 92 71

1990 80 78 97 115 88 113 54 81 92 128

2000 88 219 201 113 98 101 69 116 146 157

2010 294 196 227 193 173 130 298 227

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8A 1872 to 2017 146 years Series 15

[B] Entire series, effect on correlation ( .596) is:

Lower 1911> -.027 1893> -.018 1985< -.015 1970< -.012 1935> -.010 1966> -.007 Higher 1925 .024 1956 .016

8A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1872 59 40 49 50 57 45 69 107

1880 164 165 132 140 140 133 163 116 124 105

1890 94 101 151 153 188 81 95 80 131 174

1900 274 347 187 267 392 311 245 168 255 130

1910 182 193 174 196 216 153 150 120 124 185

1920 163 207 141 114 160 63 103 127 153 129

1930 154 184 178 181 181 106 65 82 137 147

1940 93 149 154 184 174 162 137 196 114 207

1950 125 147 196 165 202 267 103 141 130 135

1960 95 110 96 67 73 71 104 91 70 68

1970 60 78 71 80 61 68 60 67 119 111

1980 91 70 64 89 71 36 48 74 73 66

1990 72 91 82 127 132 124 48 57 72 118

2000 84 121 114 82 36 46 74 109 105 163

2010 171 185 195 170 226 145 231 178

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8B 1901 to 2017 117 years Series 16

[B] Entire series, effect on correlation ( .583) is:

Lower 1935> -.033 1911> -.027 1902< -.009 1959> -.009 1985< -.007 1977> -.007 Higher 1925 .024 1948 .015

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

1948 -5.1 SD

8B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 389 245 299 469 321 291 241 217 195

1910 241 226 217 226 225 245 228 154 145 171

1920 108 171 109 84 160 69 133 119 149 101

1930 141 189 148 147 192 121 64 109 136 133

1940 110 209 144 175 129 162 124 151 43 172

1950 151 173 204 156 182 248 122 134 144 156

1960 110 115 100 64 54 52 82 105 68 88

1970 93 87 64 84 78 72 54 79 132 127

1980 115 125 112 111 103 50 51 89 109 106

1990 112 121 115 135 117 77 52 64 52 91

2000 73 100 124 80 45 61 80 101 108 132

2010 139 184 239 206 217 122 214 154

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9A 1943 to 2017 75 years Series 17

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

Lower 1981< -.052 1956> -.049 1955< -.021 1963> -.017 1946< -.014 1949< -.013 Higher 1996 .050 2015 .016

9A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 273 213 239 199 233 214 229

1950 256 255 248 302 296 264 320 410 396 296

1960 303 323 312 367 327 259 194 207 189 210

1970 238 246 234 242 212 191 173 153 194 185

1980 219 137 169 177 173 179 139 222 192 207

1990 184 235 248 246 195 226 154 193 239 292

2000 251 289 289 251 213 184 244 297 257 314

2010 252 265 314 323 271 199 329 232

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9B 1938 to 2017 80 years Series 18

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

Lower 1948> -.045 1955< -.024 1956> -.023 2011< -.019 1938< -.009 1973< -.009 Higher 1996 .047 1977 .018

9B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 147 203

1940 101 228 236 197 200 234 290 326 289 312

1950 290 299 301 350 288 244 258 319 285 210

1960 211 253 225 216 239 220 174 203 175 196

1970 241 254 219 161 152 156 167 116 174 174

1980 215 176 211 178 172 169 158 224 168 215

1990 262 284 249 275 248 259 169 255 290 318

2000 273 315 329 256 227 251 307 356 280 328

2010 299 218 319 337 370 286 363 281

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

10A 1849 to 2017 169 years Series 19

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

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

1849 1898 0 -.03 .16 .14 -.06 .09 .02 -.06 .05 -.18 .16 .33\*-.21 .15 .02 .23 .04 .15 -.09 .14 -.17 .11

[B] Entire series, effect on correlation ( .657) is:

Lower 1849> -.017 1850< -.015 1996> -.011 1864> -.009 1876> -.008 1948> -.007 Higher 1935 .054 2004 .010

1849 to 1898 segment:

Lower 1849> -.076 1850< -.046 1864> -.037 1876> -.035 1856< -.021 1896> -.017 Higher 1880 .056 1887 .038

10A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1849 176

1850 130 181 140 140 126 124 114 125 135 134

1860 145 108 79 94 108 85 86 112 63 36

1870 61 38 30 23 29 24 24 10 9 10

1880 22 13 11 9 15 10 21 12 18 21

1890 24 23 42 39 67 86 133 98 161 197

1900 215 144 114 170 219 192 173 161 166 145

1910 159 116 157 147 138 113 110 58 44 70

1920 71 69 58 39 69 42 56 45 40 27

1930 30 27 27 23 27 14 19 23 42 36

1940 39 53 64 67 62 64 102 108 83 140

1950 68 68 97 105 144 255 121 222 270 189

1960 135 180 154 144 146 187 181 167 161 169

1970 211 230 172 213 165 211 128 138 172 242

1980 260 190 190 177 124 81 54 100 147 144

1990 188 244 275 262 165 266 200 196 215 226

2000 168 228 218 131 88 110 183 248 266 282

2010 214 211 297 236 200 167 229 148

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10B 1858 to 2017 160 years Series 20

[B] Entire series, effect on correlation ( .582) is:

Lower 1935> -.034 1936< -.013 1902< -.013 1876> -.012 1974> -.011 1921< -.007 Higher 1948 .019 1911 .019

10B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1858 128 105

1860 110 108 85 85 67 65 66 73 54 29

1870 60 43 37 18 22 17 20 7 11 5

1880 14 7 10 8 15 16 33 26 32 29

1890 39 44 97 75 118 158 200 162 261 258

1900 274 211 136 215 259 232 222 194 197 150

1910 176 117 183 165 138 118 166 110 85 94

1920 87 67 58 49 75 44 60 57 53 56

1930 47 39 38 30 46 35 25 29 44 47

1940 45 66 82 77 70 89 108 113 71 202

1950 132 175 193 247 239 327 178 295 386 244

1960 163 245 154 119 100 165 194 162 132 138

1970 163 159 112 147 149 176 110 117 148 180

1980 223 114 123 107 75 59 56 68 97 99

1990 101 142 163 190 120 178 101 125 114 126

2000 89 136 126 77 72 81 128 177 186 222

2010 186 186 236 234 219 165 260 187

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11A 1945 to 2017 73 years Series 21

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

Lower 1956> -.024 1950> -.020 1949< -.018 1951< -.009 1964> -.008 1962> -.007 Higher 2004 .014 1977 .011

11A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 305 324 325 238 280

1950 372 323 377 388 415 434 374 406 410 338

1960 350 342 372 331 388 327 270 298 297 343

1970 372 388 346 351 209 229 201 144 249 349

1980 340 228 297 356 238 289 296 406 287 309

1990 465 413 417 486 341 459 260 291 320 278

2000 210 312 303 226 147 158 204 356 362 446

2010 359 262 416 435 444 350 381 302

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11B 1950 to 2017 68 years Series 22

[B] Entire series, effect on correlation ( .678) is:

Lower 1986> -.021 1976> -.021 1966> -.016 1984< -.016 1974< -.012 1952< -.011 Higher 1996 .024 1977 .015

11B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 328 312 310 312 336 399 345 435 476 402

1960 391 459 418 359 356 333 411 360 371 377

1970 422 466 367 361 225 257 293 212 271 320

1980 297 260 263 250 166 236 305 398 248 197

1990 229 295 313 383 219 321 177 192 236 285

2000 212 238 245 174 159 186 210 295 360 414

2010 346 207 340 319 308 184 239 172

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12A 1893 to 2017 125 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

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

1893 1942 3 .20 -.15 -.05 -.08 -.18 -.16 -.13 -.15 -.15 -.15 .22|-.12 -.08 .42\* .05 .09 .17 -.10 .21 -.16 .01

1900 1949 3 .13 -.16 .01 -.03 -.20 -.15 -.06 -.10 -.17 -.14 .20|-.17 -.12 .35\* .01 .13 .13 -.13 .23 -.18 -.02

[B] Entire series, effect on correlation ( .420) is:

Lower 1903< -.041 1932< -.034 1925> -.020 1918> -.019 1908< -.013 1917> -.011 Higher 1956 .030 1911 .027

1893 to 1942 segment:

Lower 1903< -.070 1932< -.063 1918> -.032 1925> -.027 1908< -.025 1900< -.020 Higher 1911 .078 1893 .054

1900 to 1949 segment:

Lower 1903< -.065 1932< -.059 1918> -.035 1925> -.028 1908< -.023 1917> -.019 Higher 1911 .083 1935 .044

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

1918 +3.3 SD; 1932 -4.9 SD

12A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1893 78 97 87 93 115 109 95

1900 65 68 98 38 84 54 36 38 21 34

1910 40 19 26 44 40 35 59 59 67 66

1920 58 63 48 40 49 49 49 68 56 41

1930 26 34 14 33 57 48 66 80 98 106

1940 116 170 167 127 130 144 140 142 128 150

1950 137 198 184 150 139 188 119 155 193 139

1960 150 125 102 100 113 83 90 102 140 126

1970 120 126 112 125 123 89 93 98 130 165

1980 150 112 135 120 128 142 153 205 217 234

1990 224 309 339 304 229 217 158 179 165 214

2000 164 153 252 221 168 161 257 289 266 341

2010 276 208 251 211 219 202 260 250

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12B 1893 to 2017 125 years Series 24

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

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

1893 1942 0 .03 -.05 .08 -.03 .12 -.14 -.13 -.14 -.15 -.21 .30\*-.26 .04 .12 .19 -.10 .16 -.08 .13 -.21 .13

[B] Entire series, effect on correlation ( .467) is:

Lower 1899< -.036 1900< -.014 1925> -.013 2014< -.010 1931< -.010 1907< -.010 Higher 2004 .031 1911 .022

1893 to 1942 segment:

Lower 1899< -.076 1900< -.029 1931< -.021 1907< -.021 1901< -.019 1903< -.019 Higher 1911 .068 1935 .062

12B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1893 73 96 90 75 107 124 58

1900 39 26 59 32 76 58 49 30 28 48

1910 56 36 37 55 56 58 79 66 54 64

1920 59 89 78 61 77 62 52 67 61 43

1930 45 27 22 22 40 30 46 58 82 92

1940 86 134 107 129 106 145 143 132 115 166

1950 160 203 192 185 162 184 148 186 225 214

1960 151 123 133 123 86 74 77 86 78 66

1970 81 89 76 90 96 82 80 90 136 144

1980 177 152 151 155 156 146 114 179 191 248

1990 261 307 348 340 233 213 171 165 205 252

2000 238 218 250 187 107 106 225 269 243 320

2010 280 262 246 319 224 188 237 177

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13A 1932 to 2017 86 years Series 25

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

Lower 1934< -.108 1971< -.018 1996> -.014 1990< -.011 1989< -.009 1950> -.008 Higher 2004 .036 1956 .025

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

1934 1935 4.3 SD

13A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 99 89 45 67 123 103 163 175

1940 142 181 177 244 143 233 258 232 151 272

1950 264 185 293 178 196 250 119 159 141 101

1960 99 134 110 83 121 103 106 106 133 114

1970 137 93 107 95 99 111 99 103 147 153

1980 192 123 212 186 102 204 180 210 166 128

1990 136 180 207 258 249 221 209 224 227 363

2000 234 296 302 165 111 130 209 257 282 356

2010 329 343 406 275 294 205 316 257

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13B 1951 to 2017 67 years Series 26

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

Lower 2013< -.027 1973< -.020 1972< -.014 2007< -.014 1957< -.013 1964> -.012 Higher 1956 .067 2004 .021

13B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1951 373 281 335 318 288 133 175 198 168

1960 242 320 195 215 259 232 194 202 175 144

1970 155 143 75 67 76 80 100 86 113 139

1980 168 126 213 163 194 178 119 159 149 144

1990 174 280 333 363 307 292 193 216 162 285

2000 190 227 226 108 91 108 152 139 175 192

2010 215 193 262 129 172 117 207 157

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14A 1903 to 2017 115 years Series 27

[B] Entire series, effect on correlation ( .553) is:

Lower 1924< -.041 1918> -.031 1912< -.021 1917> -.017 1956> -.015 2009< -.010 Higher 1935 .061 1925 .034

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

1918 +3.8 SD

14A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 91 91 121 110 97 79 92

1910 111 60 49 84 72 73 80 87 102 62

1920 47 63 65 59 33 15 87 68 64 67

1930 65 83 79 46 133 46 75 105 98 88

1940 61 132 133 129 174 141 169 163 159 204

1950 165 175 198 260 225 313 245 268 261 225

1960 219 210 196 214 248 262 258 219 162 193

1970 222 222 176 205 133 157 137 112 151 156

1980 172 156 214 200 173 195 205 228 165 195

1990 206 230 249 211 214 179 139 145 164 220

2000 224 219 219 194 116 112 154 203 165 155

2010 153 216 262 260 184 121 216 149

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14B 1903 to 2017 115 years Series 28

[B] Entire series, effect on correlation ( .683) is:

Lower 1924< -.047 2002< -.021 1925> -.016 1904< -.016 1986> -.011 1927< -.010 Higher 1935 .072 1911 .028

14B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 99 77 135 108 80 103 70

1910 73 19 33 47 41 47 57 43 40 43

1920 51 53 58 49 24 30 61 39 62 52

1930 55 65 59 49 90 28 51 64 91 107

1940 92 144 130 132 157 159 198 212 158 191

1950 175 188 223 246 229 283 203 307 326 327

1960 302 335 255 251 195 155 178 213 210 245

1970 295 285 201 191 126 151 128 112 143 175

1980 193 172 204 213 230 250 298 346 262 275

1990 246 287 326 374 335 286 197 211 255 289

2000 271 271 172 191 150 177 221 282 261 324

2010 335 290 352 355 259 143 219 201

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15A 1987 to 2017 31 years Series 29

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

Lower 2004> -.128 2003> -.026 2008< -.026 1999< -.020 1988< -.017 2013> -.007 Higher 1996 .144 2012 .024

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

2004 +3.1 SD

15A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1987 287 219 265

1990 283 282 263 274 223 228 143 133 239 184

2000 178 247 237 221 228 188 155 225 158 207

2010 192 178 275 258 283 188 214 198

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15B 1990 to 2017 28 years Series 30

[B] Entire series, effect on correlation ( .505) is:

Lower 2004> -.121 2011< -.073 1992< -.020 2012< -.015 2003> -.014 2017> -.014 Higher 1996 .079 2009 .046

15B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1990 255 224 180 201 143 145 85 83 86 111

2000 81 174 157 153 164 140 112 216 150 269

2010 193 145 151 112 140 96 137 110

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16A 1811 to 2017 207 years Series 31

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

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

1825 1874 0 .16 -.03 .01 -.19 .06 .30 -.20 -.27 .00 -.21 .33\* .15 -.19 -.13 .00 .18 .23 -.04 -.20 -.15 .00

1850 1899 0 .10 .13 -.10 -.25 .02 .00 .02 .15 .00 .16 .31\*-.15 .03 -.22 -.18 .08 .21 -.02 .04 -.05 .04

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

Lower 1918> -.013 1842> -.011 1876> -.009 1829> -.009 1873> -.009 1832> -.008 Higher 1935 .029 1925 .017

1825 to 1874 segment:

Lower 1842> -.048 1829> -.037 1873> -.037 1832> -.029 1850> -.025 1863< -.019 Higher 1849 .028 1828 .028

1850 to 1899 segment:

Lower 1876> -.047 1873> -.043 1850> -.029 1863< -.024 1888< -.016 1862< -.015 Higher 1893 .064 1880 .050

16A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1811 69 28 23 19 43 58 64 38 37

1820 41 49 60 42 55 65 45 49 40 67

1830 73 53 50 63 56 64 57 35 29 39

1840 45 34 56 34 24 35 45 24 41 26

1850 44 50 39 30 35 37 41 34 43 36

1860 42 42 25 18 21 26 22 26 21 10

1870 11 13 20 26 25 24 21 15 11 13

1880 24 15 8 7 14 8 18 18 19 42

1890 37 46 60 38 48 37 15 29 126 190

1900 183 216 195 194 285 249 221 198 286 162

1910 204 110 194 164 126 121 141 111 141 133

1920 147 92 67 63 111 51 85 91 83 75

1930 77 111 172 126 117 60 75 102 168 183

1940 137 239 211 187 185 195 205 208 171 231

1950 188 237 196 186 194 261 150 234 287 156

1960 168 198 172 119 107 73 91 75 73 98

1970 153 81 122 141 38 74 54 40 129 136

1980 100 80 70 74 54 48 52 61 65 62

1990 60 87 112 147 95 84 58 76 87 123

2000 100 106 108 92 70 95 110 164 187 210

2010 206 251 287 274 307 241 313 231

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16B 1811 to 2017 207 years Series 32

[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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1825 1874 0 .12 .07 -.07 -.09 -.10 .09 .03 -.24 -.20 -.24 .24\* .12 -.12 -.04 .19 .22 .15 -.06 -.03 -.05 .13

[B] Entire series, effect on correlation ( .574) is:

Lower 1829> -.030 1955< -.027 1886< -.012 1832> -.011 1971< -.008 1919< -.007 Higher 1911 .015 1935 .013

1825 to 1874 segment:

Lower 1829> -.139 1832> -.040 1850> -.023 1852> -.022 1840< -.016 1872> -.015 Higher 1828 .033 1847 .027

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

1829 +4.1 SD; 1832 +3.2 SD

16B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1811 70 28 24 20 43 51 52 40 40

1820 40 55 56 48 55 59 37 41 29 115

1830 91 69 65 68 71 59 55 38 33 31

1840 34 36 40 31 23 27 36 20 44 34

1850 52 56 63 41 47 66 54 52 54 43

1860 49 37 27 26 18 25 28 25 20 14

1870 23 24 24 13 14 16 12 8 9 16

1880 27 14 9 12 14 9 9 12 26 39

1890 32 33 34 22 34 43 29 69 183 173

1900 189 183 169 191 206 166 170 175 208 116

1910 139 87 136 157 118 122 120 93 90 67

1920 88 89 94 85 119 42 86 79 77 63

1930 82 94 160 156 152 71 80 93 193 240

1940 180 269 245 204 179 215 215 217 146 184

1950 140 180 186 194 200 105 64 158 259 219

1960 224 251 211 165 151 102 94 97 86 76

1970 119 79 90 100 52 48 45 58 57 62

1980 91 102 84 95 93 94 111 139 132 158

1990 178 164 177 179 98 104 66 80 94 121

2000 105 148 153 122 79 94 114 150 136 151

2010 178 157 205 208 177 119 176 123

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17A 1851 to 2017 167 years Series 33

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

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

1851 1900 -10 .37\*-.03 .06 -.28 -.13 .09 -.22 -.04 .09 -.37 .20| .13 .20 -.04 .12 .07 .28 -.10 -.01 .00 .17

[B] Entire series, effect on correlation ( .563) is:

Lower 1869> -.020 1910< -.017 1892< -.016 1917> -.012 1918> -.010 1893> -.009 Higher 1935 .048 1911 .026

1851 to 1900 segment:

Lower 1869> -.065 1892< -.036 1868> -.024 1857< -.020 1893> -.016 1877> -.014 Higher 1887 .095 1900 .031

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

1869 +3.7 SD

17A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1851 256 130 185 163 135 139 87 134 84

1860 110 56 82 49 46 71 52 57 74 149

1870 137 73 59 43 38 42 41 52 47 53

1880 63 52 59 51 65 70 88 58 83 100

1890 112 88 67 81 108 123 147 163 161 176

1900 244 173 192 180 175 136 124 116 111 86

1910 45 6 40 48 48 51 78 106 110 109

1920 101 121 120 108 178 91 116 143 164 122

1930 126 122 175 153 193 85 97 97 99 88

1940 72 137 94 140 144 145 157 204 120 169

1950 149 148 150 165 164 173 115 104 143 67

1960 67 98 97 105 69 51 65 98 65 89

1970 102 123 94 86 58 51 45 33 45 42

1980 46 53 46 47 52 37 35 37 53 43

1990 42 58 71 102 79 71 38 51 59 77

2000 41 42 49 44 12 26 61 116 88 122

2010 111 115 178 158 162 123 130 106

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17B 1849 to 2017 169 years Series 34

[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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1849 1898 0 .20 .01 -.04 .11 .20 .03 .00 -.37 .14 -.19 .27\*-.09 -.02 -.03 -.02 -.18 .06 -.11 -.03 -.16 .04

1850 1899 0 .20 .04 -.06 .11 .07 .01 -.02 -.36 .11 -.14 .27\*-.05 .01 -.04 -.03 -.10 .10 -.08 -.02 -.11 .01

[B] Entire series, effect on correlation ( .655) is:

Lower 1852> -.010 1942< -.008 1945< -.008 1992< -.007 1880< -.007 1947< -.007 Higher 1935 .058 2004 .015

1849 to 1898 segment:

Lower 1852> -.045 1854< -.031 1858< -.030 1859< -.030 1856< -.029 1880< -.026 Higher 1893 .099 1886 .082

1850 to 1899 segment:

Lower 1852> -.045 1858< -.030 1856< -.030 1859< -.029 1854< -.029 1880< -.027 Higher 1893 .104 1886 .079

17B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1849 138

1850 137 196 246 209 103 130 91 80 66 46

1860 113 58 43 42 35 67 88 96 78 79

1870 66 64 66 59 54 38 29 32 26 28

1880 36 28 36 44 65 73 126 103 107 99

1890 117 109 100 81 111 98 147 166 179 231

1900 281 207 223 220 216 152 120 124 109 86

1910 104 75 112 103 91 67 85 74 54 64

1920 61 72 71 77 156 107 152 185 218 156

1930 157 134 180 167 237 106 160 166 196 200

1940 162 259 148 142 142 113 114 99 74 130

1950 103 123 111 164 138 141 82 105 167 92

1960 64 106 81 90 69 42 27 70 65 106

1970 102 95 83 82 58 38 34 18 30 58

1980 67 91 82 73 87 77 82 124 125 86

1990 90 96 72 114 70 81 38 49 68 73

2000 44 47 76 51 14 26 67 113 97 100

2010 96 75 128 107 124 96 96 78

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18A 1954 to 2017 64 years Series 35

[B] Entire series, effect on correlation ( .497) is:

Lower 2013< -.033 2015> -.027 1973< -.024 1980< -.017 1969< -.015 2011> -.012 Higher 1956 .070 1996 .040

18A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 326 335 174 220 206 205

1960 168 182 189 176 158 138 131 153 145 104

1970 124 152 99 82 90 127 92 117 167 180

1980 165 189 267 257 289 323 333 405 460 398

1990 413 412 407 361 348 335 261 259 356 405

2000 357 382 382 328 299 314 290 358 338 430

2010 351 404 367 267 307 326 285 273

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18B 1953 to 2017 65 years Series 36

[B] Entire series, effect on correlation ( .509) is:

Lower 1997< -.031 2016< -.026 2017> -.021 1961< -.021 1954< -.019 1986> -.014 Higher 1996 .033 2004 .025

18B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 290 204 367 202 241 238 232

1960 182 162 210 187 178 163 193 136 130 131

1970 207 290 174 149 106 180 121 109 132 145

1980 173 127 181 172 206 223 261 299 343 346

1990 267 259 351 313 301 280 201 163 277 272

2000 229 250 294 266 223 248 309 347 263 384

2010 286 306 355 272 309 293 275 308

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PART 7: DESCRIPTIVE STATISTICS: PIRU\_MANSFIELD\_CORR1-50 08:46 Tue 02 Jan 2018 Page 6

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

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

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

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

1 1A 1904 2017 114 4 0 .541 2.05 3.93 .796 .796 .218 2.59 .353 -.013 1

2 1B 1909 2017 109 4 0 .495 2.26 5.27 1.187 .888 .225 2.47 .327 -.033 1

3 2A 1931 2017 87 3 0 .591 2.31 6.74 1.156 .631 .279 2.87 .436 -.064 1

4 2B 1931 2017 87 3 0 .691 2.37 4.84 1.058 .831 .216 2.50 .352 -.053 1

5 3A 1861 2017 157 6 0 .635 1.41 3.08 .467 .746 .190 2.62 .426 -.050 1

6 3B 1861 2017 157 6 0 .626 1.32 3.06 .514 .744 .216 2.66 .424 -.015 1

7 4A 1858 2017 160 6 0 .627 1.17 2.96 .617 .859 .245 2.54 .332 -.062 1

8 4B 1825 2017 193 7 2 .442 1.05 3.17 .690 .891 .227 2.58 .336 -.049 1

9 5A 1922 2017 96 4 2 .559 2.22 4.62 1.124 .839 .266 2.58 .302 -.055 1

10 5B 1923 2017 95 4 0 .504 2.71 6.97 1.491 .914 .202 2.34 .296 -.015 1

11 6A 1859 2017 159 6 0 .580 1.38 4.82 .966 .908 .247 2.84 .518 -.047 1

12 6B 1859 2017 159 6 0 .550 1.68 4.90 1.307 .930 .218 2.61 .332 .024 1

13 7A 1781 2017 237 9 2 .503 1.13 3.07 .670 .797 .285 2.72 .427 .009 1

14 7B 1781 2017 237 9 2 .457 .78 2.98 .540 .808 .283 2.59 .360 -.021 1

15 8A 1872 2017 146 6 0 .596 1.30 3.92 .625 .727 .256 2.65 .407 -.053 1

16 8B 1901 2017 117 4 0 .583 1.40 4.69 .711 .758 .267 2.54 .347 -.033 1

17 9A 1943 2017 75 3 0 .508 2.43 4.10 .574 .692 .153 2.55 .450 -.060 1

18 9B 1938 2017 80 3 0 .568 2.43 3.70 .612 .691 .171 2.45 .481 -.062 1

19 10A 1849 2017 169 7 1 .657 1.21 2.97 .756 .871 .252 2.58 .384 .036 1

20 10B 1858 2017 160 6 0 .582 1.18 3.86 .753 .846 .263 2.68 .499 .000 2

21 11A 1945 2017 73 3 0 .720 3.27 4.86 .770 .543 .187 2.38 .370 .030 1

22 11B 1950 2017 68 2 0 .678 3.02 4.76 .826 .659 .191 2.56 .470 -.033 1

23 12A 1893 2017 125 5 2 .420 1.29 3.41 .750 .910 .209 2.65 .461 -.084 1

24 12B 1893 2017 125 5 1 .467 1.29 3.48 .792 .913 .213 2.61 .474 .067 1

25 13A 1932 2017 86 3 0 .458 1.83 4.06 .781 .718 .249 2.61 .492 .059 1

26 13B 1951 2017 67 2 0 .513 1.90 3.73 .741 .690 .239 2.53 .458 .015 3

27 14A 1903 2017 115 4 0 .553 1.54 3.13 .663 .852 .212 2.64 .449 .043 1

28 14B 1903 2017 115 4 0 .683 1.76 3.74 .980 .917 .214 2.42 .328 -.041 1

29 15A 1987 2017 31 1 0 .526 2.21 2.87 .443 .363 .182 2.51 .586 .102 1

30 15B 1990 2017 28 1 0 .505 1.50 2.69 .503 .471 .258 2.84 .669 .007 2

31 16A 1811 2017 207 8 2 .646 .98 3.13 .750 .889 .275 2.71 .478 -.018 1

32 16B 1811 2017 207 8 1 .574 .94 2.69 .648 .889 .239 2.69 .296 -.042 1

33 17A 1851 2017 167 6 1 .563 .97 2.56 .480 .781 .252 2.78 .451 -.013 3

34 17B 1849 2017 169 7 2 .655 1.02 2.81 .527 .798 .256 2.67 .348 -.056 1

35 18A 1954 2017 64 2 0 .497 2.65 4.60 1.059 .908 .144 2.55 .434 -.039 1

36 18B 1953 2017 65 2 0 .509 2.35 3.84 .720 .669 .197 2.78 .486 .014 1

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Total or mean: 4506 169 18 .564 1.52 6.97 .760 .814 .236 2.87 .404 -.020

- = [ COFECHA PIRU COF ] = -