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Yew tree-ring report HRBS01/21–Bridge Sollers

T.R.Hindson, A.K.Moir and T. Hills 2021

Yew Tree-ring report HRBS01/21 – Bridge Sollers

Dendrochronological analysis of a yew tree bole and branches from St. Andrew's churchyard,
Bridge Sollers, Hereford, England.

T.R.Hindson ^{1, 2} A.K.Moir ^{2, 3, 4} and T. Hills ^{1, 2} 2021

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University, ⁴ Tree-Ring Services

This dendrochronological report may be subject to adjustment as work progresses. Please contact the authors for the latest version before citing.

Summary

A 371 cm circumference bole round and two branch rounds at the break of crown from a wind-thrown yew *Taxus baccata* L. were investigated by dendrochronological analysis, and the samples matched to form a 280 year mean chronology 1740-2019. The branch sections were taken at 709 and 737 cm from ground and yielded two sub-series of rings spanning 1763 to 2019 and 1768 to 2019. The age of the yew is estimated at minimally over 300 years.

Introduction

Bridge Sollers churchyard of St. Andrew in Herefordshire contains two main yew features, a large hollow yew with an exposed root system, and a line of smaller yews on the eastern boundary. Mapping and mensuration of these has been carried out by the Ancient Yew Group (AYG) since 2002, AYG (2020). The yew HRBS01 which grew in the centre of this eastern boundary line of yews fell in early 2020, apparently because it was significantly undermined by burrowing animals. The AYG data concerning the fallen yew shows that it was first recorded by Tim Hills in 2002, and in 2016 it had a minimum circumference of 366cm. The fallen yew was at NGR SO 41491 42627.

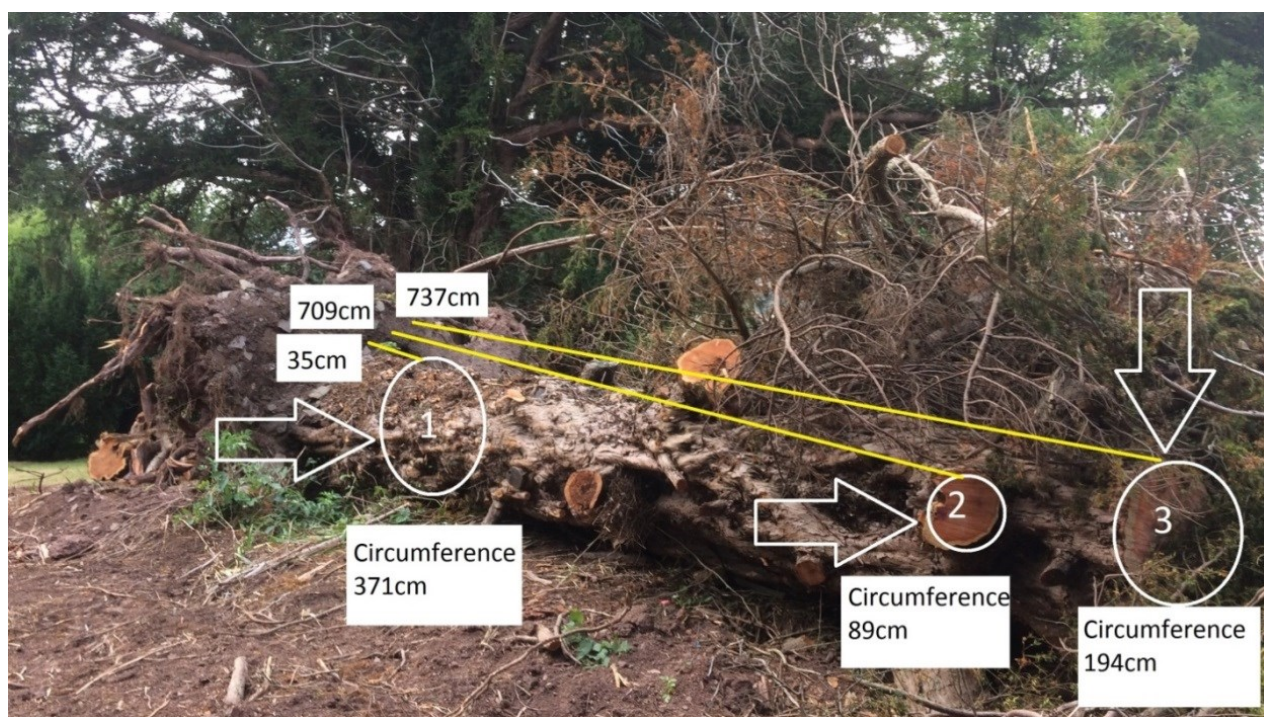
The age of the yew was investigated using dendrochronology. Unlike simple ring counts dendrochronology is able to produce exact ages for some tree species in the UK. A dendrochronological investigation can indicate missing, microscopic or merged tree-rings that are usually missed in a simple ring count. Furthermore, wood of uncertain date can be located in time by cross-matching against dated reference chronologies.

Objectives

The main objective was to dendrochronologically match bole and branch samples.

Method

Figure 1: Yew HRBS01 showing sampling locations



Three full rounds were cut from the fallen yew by an operative using a chainsaw during clearance, and transported from the site (Figure 1). The rounds were further processed into scanner appropriate sizes using an MS271/C chainsaw and selected for the most even ring configurations. Standard forestry rated PPE was used including chainsaw trousers, boots, helmet with faceguard and ear defenders, and gloves. Where necessary a 30cm Silky “pull-saw” was used in separating sections to avoid destroying measurable rings. Gloves and eye protection were worn during hand tool use. The sections were polished using progressively finer grits from P80 to P1200. A surgical mask KN95 was worn during sanding. The resulting yew dust is extremely fine, and toxic.

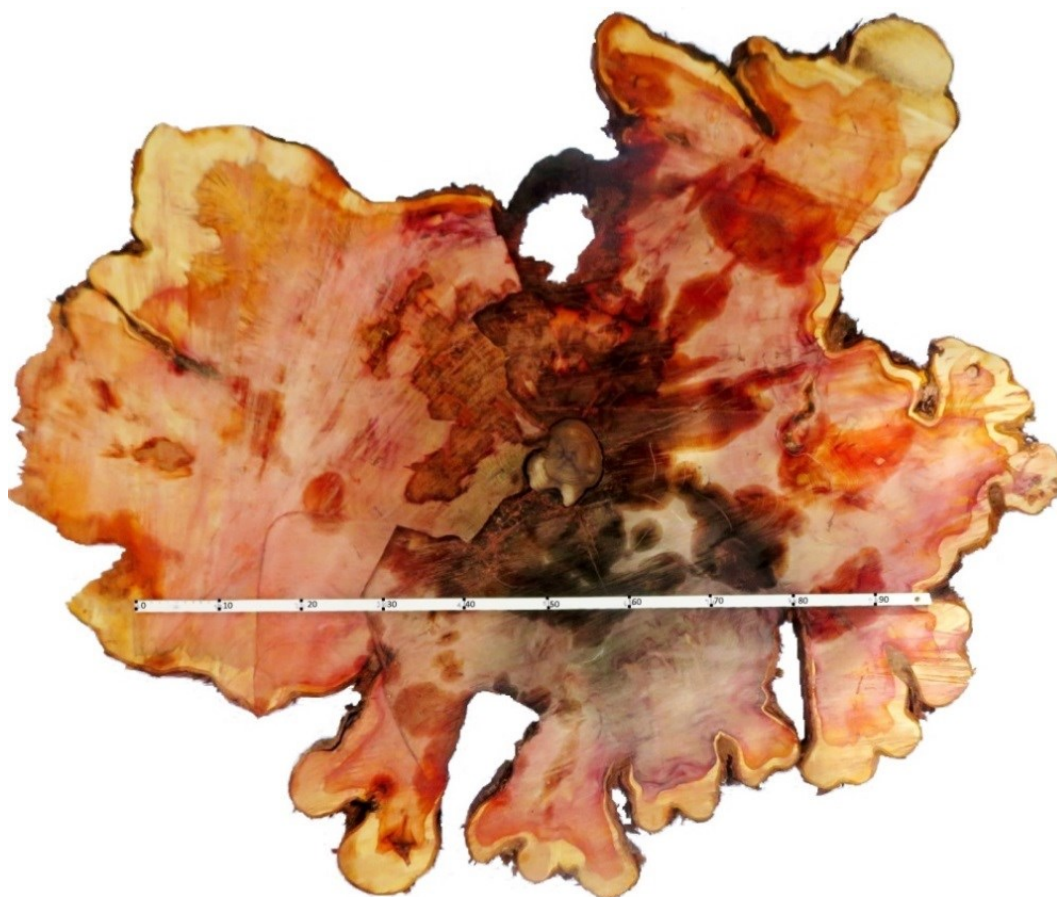
Samples from round 1 (base round) were labelled A to E. samples from branch rounds 2 and 3 were labelled J-K and F-I respectively. Suitable overlapping sub-sections were scanned at 3,200 (base resolution) to 12,800 dpi (maximum resolution) on an Epson Perfection V370 photo scanner linked to a Panasonic CF-52 laptop running MS Win 7, 64 bit. An SSD was installed to

improve speed of image handling. To avoid eye damage the scanner was covered with a cloth where the sample lifted the lid and exposed the scanning lights.

Cybis Coordinate Recorder was used to create .pos files from ring widths on the scanned images, and these sub-sections were overlapped in Cybis CDendro to yield .wid files of complete runs per sample for between sample comparisons (Table 1).

All matching series were then imported into a dendrochronological program suite developed by Ian Tyers of Sheffield University (Tyers 1999). The statistical correlations are reported as t values derived from the original CROS73 algorithm (Baillie and Pilcher 1973). A value of 3.5 or over is usually indicative of a good match as it represents the value of t which should occur by chance only once in every 1000 mismatches (Baillie 1982), and the higher the t value, the closer to congruency in the cross-matching. Correlations were made between all viable members A to K of HRBS01 (Table 1). Measured ring widths are provided in the Appendix.

Figure 2: HRBS01 sample 1 -horizontal bole section at 35cm from ground (underside)



Scale: 10cm divisions. Circumference 371cm.

Figure 3: HRBS01 A-E selected and divided for scanning (upper side)

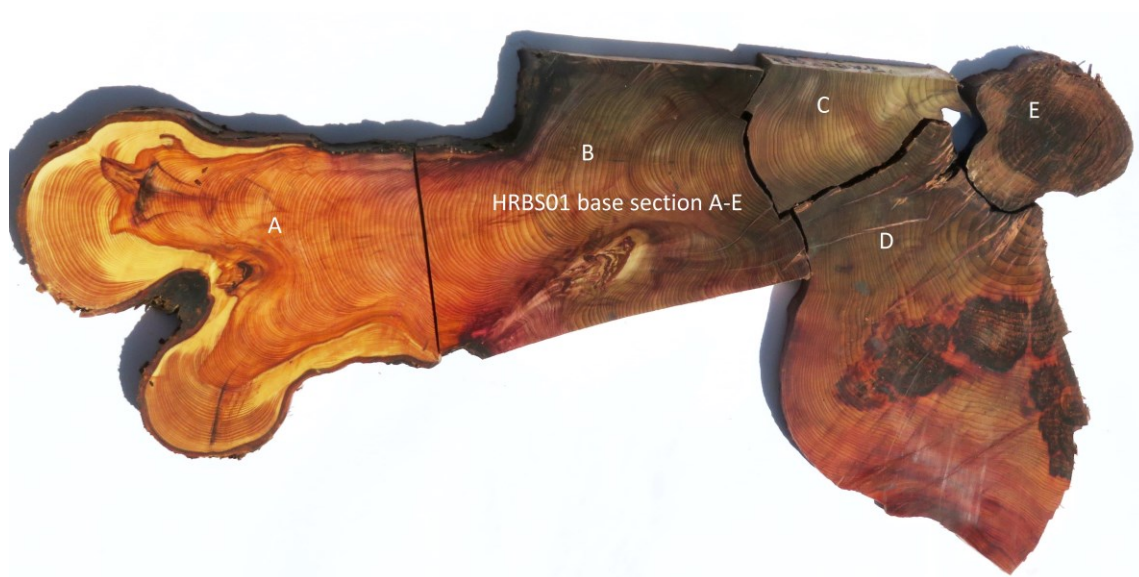
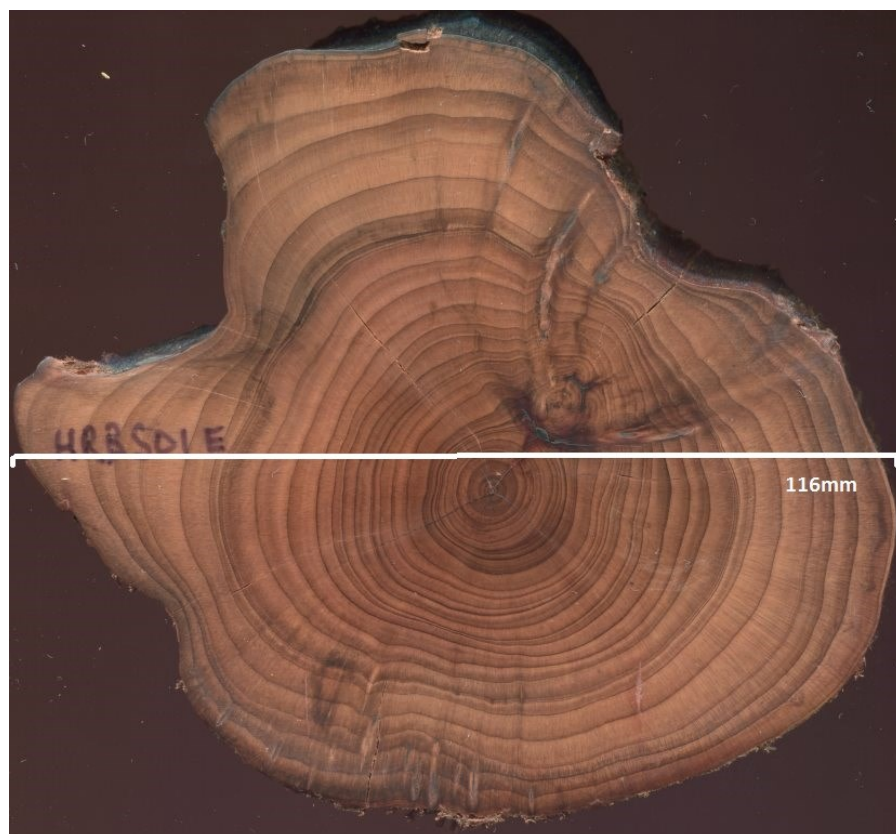


Figure 4: HRBS01E bole pith bearing sample at root crown level



Sample E which contained the pith could not be precisely dated due to a complete ring-shake line containing decay and causing discontinuity, and a high incidence of faint rings which could not be confirmed as representing annual growth.

Results

Table 1 Cross-correlation for the individual series in HRBS01.

Filenames	Start dates	End dates	HRBS01B	HRBS01D	HRBS01F	HRBS01G	HRBS01H	HRBS01I	HRBS01J	HRBS01K
HRBS01A	AD1894	AD2019	\	\	\	5.07	10.94	9.66	\	9.34
HRBS01B	AD1802	AD1907		4.49	4.13	6.87	10.32	\	4.71	4.93
HRBS01D	AD1740	AD1817			-	\	-	\	3.04	3.15
HRBS01F	AD1783	AD1860				\	4.34	\	5.58	-
HRBS01G	AD1861	AD2019					8.28	3.82	\	6.92
HRBS01H	AD1768	AD1942						\	4.66	9.66
HRBS01I	AD1935	AD2019							\	4.03
HRBS01J	AD1763	AD1833								11.09
HRBS01K	AD1764	AD2013								

Figure 4 Relative positions of series in HRBS01

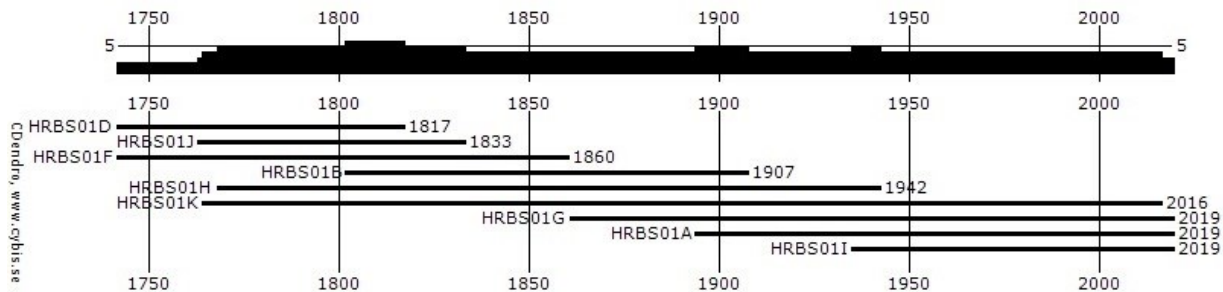
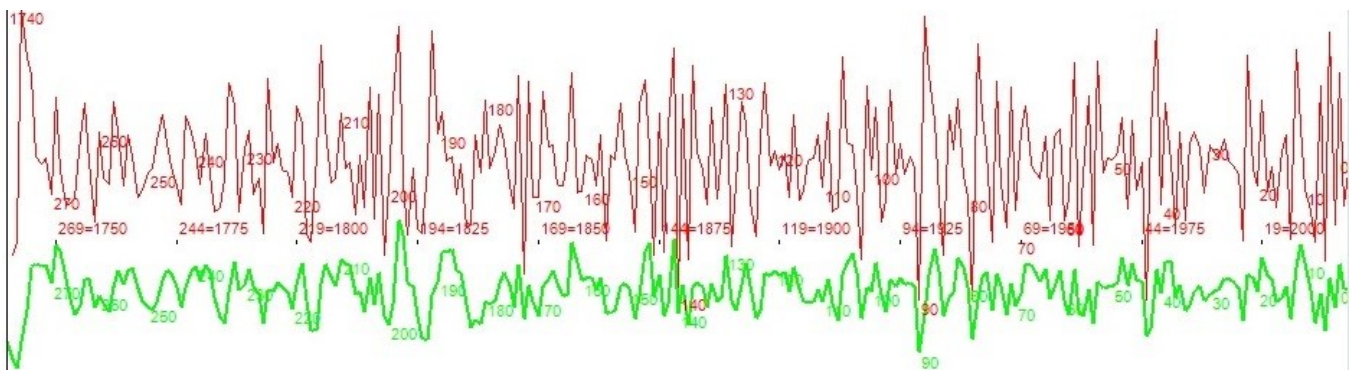


Figure 5 HRBS01 A to K and? HRBS01 mean chronology 1740-2019



CDendro output, HRBS01. Upper/Red: P2YrsL: Proportion of last two years growth LIMITED (2,0,T,1,0). Lower/Green: Heavily detrended ring widths.

Table 2 Dating evidence for the series HRBS01 against yew reference chronologies

HRBS01 dated AD 1740 TO AD 2019					
File	Start Date	End Date	t-value	Overlap (yr.)	Reference chronology
UKYEW16	AD1690	AD2009	9.18	270	UK yew reference chronology (Moir unpublished)
WHCX01	AD1691	AD2002	8.06	263	Yew - West Horsley - Surry (Moir 2004a)
HVYEW00	AD1789	AD2000	7.83	212	Yew - Happy Valley - Coulsdon - Gt London (North 2000)
SPGY01	AD1725	AD1984	7.64	245	Yew - Odstock - Wiltshire (Hindson and Moir 2020b)
GUPY01	AD1795	AD2003	7.50	279	Yew tree - Pewley Cottage - Guildford - Surrey (Moir 2004b)
CAPELYEW	AD1865	AD2002	6.58	138	Yew - Churchyard - Capel - Surrey (Moir 2003b)
ROSLIN	AD1813	AD2006	6.46	194	Yew - Roslin - Scotland (Webster 2008)
HPYEW92	AD1690	AD1992	6.15	253	Yew - Hampton Court Palace - Gt London (Moir 1999)
THOR-YEW	AD1879	AD2002	6.11	124	Thorley Yew - Hertfordshire (Moir 2003a)
RUAK01	AD1747	AD1989	5.62	250	Yew branch - Ankerwyke yew - Buckinghamshire (Moir 2005a)
SOMW01	AD1640	AD2018	5.58	279	Yew branch - New Forest - Hampshire (Hindson and Moir 2020a)
HAMYEW04	AD1806	AD2004	5.41	199	Yew - Churchyard - Hambledon - Surrey (Moir 2005b)

Discussion

Chronologies

HRBS01 produced good matches with reference chronologies (Table 2), but in contrast to the yew branch chronology SOMW01/20, Hindson and Moir (2020), the chronology HRBS01 does not match strongly with any known oak chronologies, the significant matches are with yew reference chronologies. The reason for this difference is not well understood and may be the subject of further research.

Samples from the HRBS01 branch and bole rounds matched one another satisfactorily and could be combined to create a mean chronology. Moir and Leroy (2011) note that in comparison with the probable ages of large hollow yews, relatively low ring counts have been found on the bole remnants of those studied so far. Here it is shown that both the break of crown branch material and the substantial and largely intact round from the base are useful in yielding a long chronology; and the practice of sampling branches, particularly those which are lost through failure, felling or unavoidable tree surgery is a promising direction for extending the yew chronology data and utilizing wood from different locations within the same tree. Here break of crown branch material was dated and utilized in exact chronological context.

Material discontinuities

Sample E, the pith bearing section of HRBS01 (Figure 4) was discontinuous with the remainder because it was completely encircled by a ring shake line which may have contained narrow decayed tree-rings. An apparent catastrophic event around 1740 appears to have seriously damaged the young yew. There was no overlap which could have allowed dating of sample E and the sample could not be separately dated against reference chronologies due to insufficient length.

Ageing and prior ring counts

Sample E contained poorly defined structures which may or may not have been indicative of annual growth (Figure 4). There were 26 certain tree-rings visible in this pre-1740 sample. Dendrochronology was not possible on the sample, but a minimum age for the yew was calculable. The yew began growing before AD1714 and was minimally in excess of 300 years old. Fortuitously the first author visited this site in 2003 in time to ring count the cut trunks of two other partly removed wind-thrown yews from the eastern boundary line before the wood on the bole cuts decayed too far (Hindson 2008). The first example yielded a complete ring count of 292 from the bark to the pith at c2 meters from the ground. It had a circumference of 226cm. The ring count of the second example was 278 at c2 metres from the ground and complete from the bark to near the pith, which was decayed. This second example was 218cm in circumference. These counts compare closely with the results from HRBS01. The previous ring count evidence together with the data from HRBS01 is suggestive of the notion that all of the yews in the line on the eastern churchyard boundary were planted together early in the 18th century.

Summary outcomes

- The 371cm-girth yew HRBS01 is identified to exceed 300 years in age.
- A significant dendrochronological match was found between branch and bole material.
- A 280-year yew chronology HRBS01 spanning 1740-2019 has been developed.

Conclusion

A wind-thrown yew HRBS01 has yielded a 280 year chronology spanning 1740-2019. The chronology is developed from one bole round and two branch samples from the break of crown. These results would have been difficult to obtain by taking Pressler cores from the bole. Dendrochronological investigation of yew branches is promising in terms of dating not only individual yews but the features of which they are composed.

Acknowledgements

Thanks are due to the community of Bridge Sollers who reported this fallen yew to the Ancient Yew Group, Claire Hancock who photographed the yew and who organised the visit with Tim Hills, and particularly Keith Johnson who accurately cut the samples to the exact specification requested.

The on-site measurements, liaison and collection of samples were carried out by Tim Hills.

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Appendix

Mean chronology

Title : Yew tree - St Andrews - Bridge Sollers - Hereford [HRBS01]

Raw Ring-width TABA data of 280 years length

Dated AD1740 to AD2019

Average ring width 127.44 Sensitivity 0.23

124	78	73	167	326	498	558	447	528	360
603	412	287	183	158	108	202	183	102	145
124	121	183	141	94	120	111	115	94	75
80	92	123	132	133	114	87	107	122	139
124	175	163	150	103	94	124	166	135	150
169	147	126	87	121	118	118	107	103	75
111	148	112	65	82	141	171	153	143	183
173	190	149	152	117	163	120	158	112	100
120	225	203	131	127	89	62	60	116	117
153	145	147	134	144	105	67	70	70	92
87	99	116	124	102	85	143	84	123	119
112	162	179	207	189	175	179	276	249	205
209	194	166	175	112	109	109	146	152	147
112	144	211	216	146	169	102	121	211	111
148	88	141	172	166	135	159	122	122	170
125	106	136	172	164	107	126	189	185	185
174	172	141	175	144	119	118	118	138	121
150	115	91	148	152	151	132	78	120	116
148	104	76	101	95	107	95	94	87	26
58	90	115	84	46	65	76	104	99	82
37	62	95	94	62	85	75	54	84	69
83	104	122	107	104	119	85	101	102	94
74	111	77	57	77	54	77	80	83	81
90	111	89	109	102	99	45	53	99	82
107	110	71	84	70	72	82	86	75	72
73	77	91	97	95	89	63	106	99	89
118	110	103	78	76	89	64	103	114	105
85	51	63	37	72	55	90	76	72	81

Chronology elements by sample

Title : HRBS01A

Raw Ring-width UNKN data of 126 years length

Dated AD1894 to AD2019

Average ring width 151.40 Sensitivity 0.24

250	170	194	318	323	300	301	308	266	283
282	241	262	274	261	253	282	201	177	247
268	272	248	170	225	233	294	187	124	167
175	183	151	149	130	24	59	112	156	146
85	72	72	111	120	77	40	62	124	148
94	131	117	82	120	94	109	150	167	166
168	167	109	137	129	122	91	145	90	65
100	69	109	134	140	148	186	204	164	193
187	163	52	51	120	110	144	147	116	130
82	103	100	118	84	71	54	59	103	130
120	103	91	150	132	140	164	179	153	107
97	141	126	178	198	220	199	105	104	65
84	80	138	132	119	151				

Title : HRBS01B

Raw Ring-width UNKN data of 106 years length

Dated AD1802 to AD1907

Average ring width 184.47 Sensitivity 0.25

78	52	66	161	181	175	150	191	177	188
157	217	155	254	172	234	141	120	129	267
264	157	155	108	77	97	208	181	200	147
204	226	253	183	122	101	73	98	102	121
145	173	180	165	248	157	229	163	137	200
272	306	310	251	291	378	284	244	222	200
183	214	134	141	144	197	209	142	106	159
240	273	238	246	157	186	292	155	191	122
215	373	362	276	329	259	228	283	231	142
170	212	186	102	119	195	203	187	168	122
94	151	105	80	78	58				

Title : HRBS01D

Raw Ring-width UNKN data of 78 years length

Dated AD1740 to AD1817

Average ring width 148.06 Sensitivity 0.38

124	78	73	167	326	498	558	447	528	360
603	412	287	183	158	108	202	183	102	145
124	121	183	204	161	166	147	152	177	124
76	146	234	261	240	204	147	176	249	183
179	106	112	28	50	46	132	141	13	31
42	27	55	8	124	107	112	87	44	41
50	59	36	47	25	81	85	71	73	92
84	88	30	40	36	66	42	42		

Title : HRBS01F

Raw Ring-width UNKN data of 78 years length

Dated AD1783 to AD1860

Average ring width 185.72 Sensitivity 0.24

303	205	201	244	330	311	348	394	407	331
219	226	188	165	183	209	104	206	277	259
109	125	165	148	175	172	246	230	291	217
184	149	185	129	155	149	136	104	198	204
149	136	101	65	42	87	117	194	184	129
120	170	141	66	58	106	141	135	146	165
141	86	76	167	94	101	139	155	200	206
267	219	215	210	291	337	255	294		

Title : HRBS01G

Raw Ring-width UNKN data of 159 years length

Dated AD1861 to AD2019

Average ring width 64.64 Sensitivity 0.33

279	220	202	111	100	84	142	187	174	135
155	202	197	122	78	50	66	165	108	164
101	143	130	139	121	111	84	81	106	85
86	114	158	124	83	99	132	145	175	184
182	138	169	126	104	96	87	79	61	59
34	26	58	77	95	59	25	30	26	42
37	38	51	32	35	36	30	26	16	26
37	32	21	18	30	25	32	27	20	9
19	12	15	12	22	19	13	21	15	18
26	17	19	18	20	14	12	20	4	5
11	5	12	18	9	24	21	22	24	23
27	21	27	16	15	11	13	25	18	28
25	23	40	23	25	28	23	16	35	79
76	58	46	51	64	25	69	92	83	123
84	73	44	66	74	28	85	102	58	36
32	62	28	75	49	72	46	41	34	

Title : HRBS01H

Raw Ring-width UNKN data of 175 years length

Dated AD1768 to AD1942

Average ring width 136.71 Sensitivity 0.25

74	90	134	100	122	120	124	129	87	127
110	149	123	249	167	188	164	159	140	197
207	175	182	179	162	163	181	187	195	155
136	118	143	203	158	119	171	162	225	171
208	233	212	227	200	238	194	258	203	282
169	149	187	275	229	153	156	122	78	92
174	137	166	159	165	172	143	87	69	105
77	114	89	91	112	121	108	64	120	63
125	125	84	124	121	132	92	95	87	194
179	159	180	162	140	154	105	110	103	124
111	134	95	129	206	217	127	189	121	136
240	121	175	92	138	103	91	61	100	88
95	156	84	81	123	137	111	77	103	163
148	176	153	161	136	166	138	105	99	94
121	104	139	109	86	129	136	138	147	98
136	110	120	77	62	92	113	120	110	126
131	43	103	135	169	98	47	74	95	140
116	102	50	88	139					

Title : HRBS01I

Raw Ring-width UNKN data of 85 years length

Dated AD1935 to AD2019

Average ring width 122.79 Sensitivity 0.23

69	102	124	106	102	52	107	147	120	75
126	119	104	170	133	150	182	244	179	173
241	179	215	222	207	180	251	200	142	168
125	136	124	135	128	121	162	131	151	136
164	81	93	144	110	130	130	92	50	62
77	98	130	140	150	133	150	177	167	152
126	86	124	119	83	118	111	109	93	83
93	67	92	102	105	82	47	61	44	57
36	61	52	58	60					

Title : HRBS01J

Raw Ring-width UNKN data of 71 years length

Dated AD1763 to AD1833

Average ring width 86.72 Sensitivity 0.32

78	60	95	85	111	53	39	43	70	84
94	84	70	58	65	74	145	71	173	212
119	43	34	46	75	68	89	107	64	44
23	39	56	56	52	59	48	69	104	70
27	57	134	182	157	130	161	163	184	157
115	83	99	81	90	35	38	76	151	139
87	90	63	51	42	55	83	105	112	103
78									

Title : HRBS01K

Raw Ring-width UNKN data of 250 years length

Dated AD1764 to AD2013

Average ring width 81.10 Sensitivity 0.32

61	99	101	84	73	49	67	52	53	55
84	56	56	62	58	82	124	172	164	116
53	33	58	87	77	111	120	60	39	23
37	52	64	62	71	67	87	98	72	41
53	148	205	171	127	179	177	167	138	119
90	121	98	145	69	57	108	237	182	109
101	54	39	28	57	71	100	127	135	77
10	10	11	18	24	16	24	40	44	61
34	38	38	23	39	51	75	124	119	124
136	141	129	244	196	162	142	137	123	132
101	87	108	123	102	139	112	133	196	178
99	163	83	97	150	61	62	37	69	83
73	83	96	58	85	137	100	117	138	181
150	107	116	140	106	91	66	90	74	108
70	67	59	79	91	67	123	119	77	161
129	102	75	21	90	96	137	118	80	95
62	90	83	73	64	21	44	76	104	73
35	82	88	115	129	113	34	37	55	95
68	61	47	18	27	35	55	61	62	65
59	50	39	43	40	43	23	38	16	10
22	15	42	42	37	27	31	51	40	67
71	54	39	57	108	90	126	140	55	118
113	84	104	76	60	34	26	24	27	45
60	63	53	84	55	51	68	67	80	68
61	48	37	58	54	37	23	20	27	13