

COMPARATIVE TABLE OF WOOD PROPERTIES BY RATIO

WOOD SPECIE ¹	Mass (kg/m ³) - Air dried density at 12% moisture content)	Modulus of Rupture (MPa) – bending strength	Modulus of Elasticity (GPa) - stiffness	Mass : Strength ratio (rounded to 3 decimals)	Mass : Elasticity ratio (rounded to 3 decimals)	Strength : stiffness ratio (rounded to 3 decimals)	SCORE
NORTHERN HEMISPHERE							
Yew (<i>Taxus baccata</i> and <i>brevifolia</i>)	705	105	9.3	0.151	0.013	0.088	0.252
Hickory (<i>Carya</i> spp.)	806	132	11	0.164	0.014	0.083	0.261
Rock Maple (<i>Acer saccharum</i>)	706	109	11	0.154	0.015	0.101	0.270
Black Locust (<i>Robinia pseudoacacia</i>)	773	134	14	0.173	0.018	0.104	0.295
White Ash (<i>Fraxinus americana</i>)	672	103	12	0.153	0.018	0.116	0.287
European Ash (<i>Fraxinus excelsior</i>) ²	761	113	12.9	0.148	0.017	0.114	0.279
Elm (<i>Ulmus</i> spp.)	706	102	10.6	0.144	0.015	0.103	0.262
Osage Orange (<i>Maclura pomifera</i>)	950	177	13	0.186	0.014	0.073	0.273
Lemonwood, Degame (<i>Calycophyllum candidissimum</i>)	800	154	15.7	0.192	0.020	0.102	0.314
AUSTRALIAN³							
Belah (<i>Casuarina castata</i>) (NSW)	1150	121	16	0.105	0.014	0.132	0.251
Black Apple (<i>Planchonella australis</i>) (NSW)	880	145	17	0.165	0.014	0.117	0.286
Black Bean (<i>Castanospermum australe</i>) (NSW)	770	115	15	0.149	0.019	0.130	0.298
Blackbutt (<i>Eucalyptus pilularis</i>) (NSW, QLD)	900	144	19	0.160	0.021	0.132	0.313
Black Wattle (<i>Acacia mearnsii</i>) (All Eastern States)	740	124	18	0.167	0.024	0.145	0.336
Blackwood (<i>Acacia melanoxylon</i>)	640	99	13	0.156	0.020	0.131	0.307
Blue Gum Southern (<i>Eucalyptus globus</i>) (VIC, TAS)	900	146	20	0.162	0.022	0.137	0.321
Blush Tulip Oak (<i>Argyrodendron actinophyllum</i>) (NSW)	810	12	21	0.153	0.026	0.169	0.348
Blush Walnut (<i>Beilschmiedia obtusifolia</i>) (NSW)	750	118	18	0.157	0.024	0.152	0.333
Bonewood (<i>Emmenosperma alphitonioides</i>) (NSW)	860	164	23	0.190	0.027	0.140	0.357

¹ Data sourced from - **1999 Wood Handbook**, United States Department of Agriculture Forest Products Laboratory.

² Data on European Ash (*Fraxinus excelsior*) - <http://tropix.cirad.fr/temperate/FRENE.pdf>

³ Bootle, Keith R., **Wood in Australia**, 2nd edition, McGraw Hill 2010, ISBN 13: 9780071014014, 10: 0071014012

WOOD SPECIE	Mass (kg/m ³) - Air dried density at 12% moisture content)	Modulus of Rupture (MPa) – bending strength	Modulus of Elasticity (GPa) - stiffness	Mass : Strength ratio (rounded to 3 decimals)	Mass : Elasticity ratio (rounded to 3 decimals)	Strength : stiffness ratio (rounded to 3 decimals)	SCORE
Broad-leaved Peppermint (<i>Eucalyptus dives</i>) (VIC)	820	110	14	0.134	0.017	0.127	0.278
Broad leaved Red Ironbark (<i>Eucalyptus australiana</i>) (NSW)	1140	167	24	0.146	0.021	0.144	0.311
Brownbarrel (<i>Eucalyptus fastigata</i>) (NSW, VIC)	750	107	14	0.142	0.019	0.131	0.292
Brown Mallet (<i>Eucalyptus astringens</i>) (WA)	980	179	19	0.182	0.019	0.106	0.307
Brown Stringybark (<i>Eucalyptus baxteri</i>) (NSW, VIC)	900	130	16	0.144	0.017	0.123	0.284
Brown Tulip Oak (<i>Argyrodendron trifoliolatum</i>) (NSW)	860	118	18	0.137	0.021	0.152	0.310
Brush Box (<i>Tristania conferta</i>) (NSW, QLD)	900	123	15	0.137	0.017	0.122	0.276
Celery Top Pine (<i>Phyllocladus aspenifolius</i>) (TAS)	650	98	12	0.150	0.018	0.122	0.290
Coast Grey Box (<i>Eucalyptus bosistoana</i>) (NSW, VIC)	1100	163	21	0.148	0.019	0.129	0.296
Crow's Ash (<i>Flindersia australis</i>) (NSW, QLD)	950	135	17	0.142	0.018	0.126	0.286
Dunn's White Gum (<i>Eucalyptus dunnii</i>) (NSW)	800	135	22	0.169	0.027	0.163	0.359
Gidgee (<i>Acacia cambagei</i>) (QLD)	1250	159	18	0.142	0.014	0.113	0.269
Green Wattle (<i>Acacia decurrens</i>) (NSW)	830	106	17	0.128	0.020	0.160	0.308
Grey Box (<i>Eucalyptus microcarpia</i>) (NSW, VIC)	1120	163	20	0.145	0.017	0.123	0.285
Grey Gum (<i>Eucalyptus propinqua</i>) (NSW)	1080	140	18	0.130	0.017	0.129	0.276
Grey Ironbark (<i>Eucalyptus paniculata</i>) (NSW, QLD)	1120	181	24	0.161	0.021	0.133	0.315
Gympie Messmate (<i>Eucalyptus cloeziana</i>) (QLD)	1000	137	17	0.137	0.017	0.124	0.278
Hickory Wattle (<i>Acacia penninervis</i>) (NSW)	800	135	15	0.168	0.019	0.111	0.298
Ironwood (<i>Backhousia myrtifolia</i>) (NSW)	1020	185	20	0.181	0.020	0.108	0.309
Ivorywood (<i>Siphonodon australis</i>) (NSW)	860	148	20	0.172	0.023	0.135	0.330
Jarrah (<i>Eucalyptus marginata</i>) (WA)	820	112	13	0.136	0.016	0.116	0.268
Kanuka Box (<i>Tristania laurina</i>) (NSW)	840	145	19	0.173	0.023	0.131	0.327

WOOD SPECIE	Mass (kg/m ³) - Air dried density at 12% moisture content)	Modulus of Rupture (MPa) – bending strength	Modulus of Elasticity (GPa) - stiffness	Mass : Strength ratio (rounded to 3 decimals)	Mass : Elasticity ratio (rounded to 3 decimals)	Strength : stiffness ratio (rounded to 3 decimals)	SCORE
Karri (<i>Eucalyptus diversicolor</i>) (WA)	900	132	19	0.147	0.021	0.144	0.312
Kwila (<i>Intsia bijuga</i>) (QLD)	770	130	12	0.169	0.016	0.092	0.277
Maiden's Gum (<i>Eucalyptus maidenii</i>) (NSW, VIC)	950	147	19	0.155	0.020	0.129	0.304
Mararie (<i>Pseudoweinmannia lachnocarpa</i>) (NSW)	840	173	21	0.205	0.025	0.121	0.351
Marri (<i>Eucalyptus calophylla</i>) (WA)	850	125	17	0.147	0.020	0.136	0.303
Messmate (<i>Eucalyptus obliqua</i>) (NSW, Vic)	780	118	15	0.151	0.019	0.127	0.297
Mountain Ash (<i>Eucalyptus regnans</i>) (VIC, TAS)	680	110	16	0.162	0.023	0.145	0.310
Mountain Grey Gum (<i>Eucalyptus cypelloarpa</i>) (NSW, VIC)	880	142	18	0.161	0.020	0.128	0.309
Mulga ⁴ (<i>Acacia aneura</i>) (Inland Aust.)	1200	130	19	0.108	0.016	0.146	0.270
Myall (<i>Acacia pendula</i>) (NSW)	1100	189	19	0.172	0.017	0.100	0.289
Myrtle Beech (<i>Nothofagus cunninghamii</i>) (VIC, TAS)	700	108	14	0.154	0.020	0.129	0.303
Narrow-leaved Peppermint (<i>Eucalyptus australiana</i>) (VIC)	800	117	14	0.146	0.017	0.120	0.283
Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>) (NSW)	1090	118	16	0.108	0.015	0.136	0.259
New England Blackbutt (<i>Eucalyptus andrewsii</i>) (NSW)	930	140	14	0.150	0.015	0.100	0.265
Pink Sycamore (<i>Ceratopetalatum virchowii</i>) (QLD)	710	130	16	0.183	0.022	0.123	0.328
Red Ash (<i>Alphitonia excelsa</i>) (NSW, QLD)	740	134	19	0.181	0.026	0.142	0.349
Red Bloodwood (<i>Eucalyptus gummifera</i>) (NSW)	900	115	15	0.128	0.017	0.130	0.275
Red Ironbark (<i>Eucalyptus sideroxylon</i> and <i>E. tricarpa</i>) (VIC, NSW)	1130	135	17	0.119	0.015	0.126	0.260
Red Mahogany (<i>Eucalyptus resinifera</i>) (NSW, QLD)	950	140	18	0.147	0.019	0.129	0.295
Red Silky Oak or Beefwood (<i>Stenocarpus salignus</i>) (NSW)	830	139	17	0.167	0.020	0.122	0.309

⁴ Bootle, Keith R., **Wood in Australia**, 1st edition, McGraw Hill 1988, ISBN 0 07 451047 9

WOOD SPECIE	Mass (kg/m ³) - Air dried density at 12% moisture content)	Modulus of Rupture (MPa) – bending strength	Modulus of Elasticity (GPa) - stiffness	Mass : Strength ratio (rounded to 3 decimals)	Mass : Elasticity ratio (rounded to 3 decimals)	Strength : stiffness ratio (rounded to 3 decimals)	SCORE
Red Stringybark (<i>Eucalyptus macrorhyncha</i>) (NSW, VIC)	900	123	16	0.137	0.018	0.130	0.285
Red Tulip Oak (<i>Argyrodendron peralatum</i>) (QLD)	800	126	15	0.157	0.019	0.119	0.295
River Sheoak (<i>Casuarina cunninghamiana</i>) (NSW)	770	112	12	0.145	0.016	0.107	0.268
Rose Mahogany or Rosewood (<i>Dysoxylum fraseranum</i>) (NSW)	720	116	12	0.161	0.017	0.138	0.316
Rose Maple (<i>Cryptocarpa erythroxylon</i>) (NSW)	720	130	19	0.180	0.026	0.146	0.352
Rose Sheoak (<i>Casuarina torulosa</i>) (NSW)	920	145	20	0.158	0.022	0.138	0.318
Round-leaved Gum (<i>Eucalyptus deani</i>) (NSW)	960	140	23	0.145	0.024	0.164	0.333
Saffronheart (<i>Halfordia kendack</i>) (NSW)	950	198	21	0.208	0.022	0.106	0.336
Satinay (<i>Syncarpia hillii</i>) (QLD)	840	129	16	0.154	0.019	0.124	0.297
Silvertop Ash (<i>Eucalyptus sieberi</i>) (NSW, VIC)	820	136	17	0.166	0.021	0.125	0.312
Silvertop Stringybark (<i>Eucalyptus laevopinea</i>) (NSW)	860	143	18	0.166	0.021	0.126	0.313
Smooth-barked Apple (<i>Angophora costata</i>) (NSW)	990	132	16	0.133	0.016	0.121	0.270
Southern Mahogany (<i>Eucalyptus botryoides</i>) (NSW, VIC)	920	130	18	0.141	0.020	0.138	0.299
Silver Ash (<i>Flindersia bourjotiana</i>) (NSW)	700	122	17	0.174	0.024	0.139	0.337
Spotted Gum (<i>Eucalyptus maculata</i>) (NSW, QLD)	950	150	23	0.158	0.024	0.153	0.335
Steel Box (<i>Eucalyptus rummeryi</i>) (NSW)	1130	136	19	0.120	0.017	0.140	0.277
Sydney Blue Gum (<i>Eucalyptus saligna</i>) (NSW)	850	140	18	0.165	0.021	0.129	0.315
Tallowwood (<i>Eucalyptus microcorys</i>) (QLD, NSW)	990	134	18	0.135	0.018	0.134	0.287
Tuart (<i>Eucalyptus gomphocephala</i>) (WA)	1030	125	16	0.121	0.015	0.128	0.264
Turpentine (<i>Syncarpia glomulifera</i>) (QLD, NSW)	930	142	16	0.152	0.017	0.113	0.282
White Ash (<i>Eucalyptus fraxinoides</i>) (NSW)	700	139	23	0.198	0.033	0.165	0.396

WOOD SPECIE	Mass (kg/m ³) - Air dried density at 12% moisture content)	Modulus of Rupture (MPa) – bending strength	Modulus of Elasticity (GPa) - stiffness	Mass : Strength ratio (rounded to 3 decimals)	Mass : Elasticity ratio (rounded to 3 decimals)	Strength : stiffness ratio (rounded to 3 decimals)	SCORE
White Mahogany (<i>Eucalyptus acmenioides</i>) (NSW)	1000	130	17	0.130	0.017	0.131	0.278
White Stringybark (<i>Eucalyptus eugenioides</i>) (QLD, NSW, VIC)	880	133	17	0.151	0.019	0.128	0.298
White-topped Box (<i>Eucalyptus quadrangulata</i>) (NSW)	1030	163	18	0.158	0.017	0.110	0.285
Wandoo (<i>Eucalyptus wandoo</i>) (WA)	1110	142	17	0.128	0.015	0.120	0.263
Woollybutt (<i>Eucalyptus longifolia</i>) (NSW)	1070	128	16	0.120	0.015	0.125	0.250
Yellow Box (<i>Eucalyptus melliodora</i>) (VIC)	1100	122	14	0.110	0.013	0.115	0.238
Yellow Gum (<i>Eucalyptus leucoxylon</i>) (VIC)	1010	111	12	0.110	0.012	0.108	0.230
Yellow Stringybark (<i>Eucalyptus muellerana</i>) (NSW, VIC)	870	132	17	0.152	0.019	0.129	0.300
Yellowwood (<i>Flindersia xanthoxyla</i>) (NSW)	680	135	19	0.198	0.028	0.141	0.367
Yertchuk (<i>Eucalyptus consideniana</i>) (NSW, VIC)	930	129	16	0.139	0.017	0.124	0.280

EXPLANATORY NOTES

1. Selection criteria

All the wood species selected for this table have come from reputable published data cited above. The mechanical properties of the most commonly known classic bow woods have been cited and used as the basis of criteria for choosing specific Australian wood species. I have chosen only those Australian woods whose mechanical properties were as good or better than the classics.

2. Mass to Strength ratio

This number allows a bowyer to make an assessment about how strong a wood specie is relative to its mass. For every unit of mass (in this case every 1 kg/m³) there are a certain number of strength units (Megapascals). So, the greater the number in this column, the stronger is the wood against breaking per unit of mass. It allows one wood specie to be compared directly with another.

3. Mass to Elasticity ratio

For every mass unit (1 kg/m³), this number allows the stiffness of the wood to be compared across species.

4. Strength to Stiffness ratio

Similarly, in this ratio, for every strength unit (Megapascal) each specie has a certain number of stiffness (elasticity) units (Gigapascals). This ratio permists an across specie comparison of how stiff a wood is relative to its resistance to breaking. Gigapascals (GPa) are 1000 times greater than a Megapascal (MPa). This

number could also be read as Megapascals simply by shifting the decimal point 3 places to the right. So, in the case of Yew for instance, for every unit of strength (MPa), there are 0.088 GPa (88 MPa) of stiffness. I have deliberately kept this number as a decimal only to keep all the units from 1, 2 and 3 above suitable for the score rating below.

5. SCORE

The score is simply the addition of the ratios of **mass : strength + mass : elasticity + strength : stiffness**. This simple trick allows a quick scan of the data to reveal which wood species have the best prospects of being used as a bow wood. A high score guarantees nothing in terms of performance, but it does indicate which wood species are most likely to be suitable candidates.