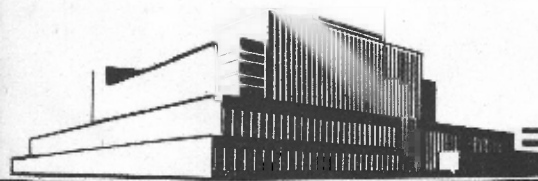


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STANDARD TERMS FOR DESCRIBING WOOD

No. 1169

Revised February 1956



FOREST PRODUCTS LABORATORY
MADISON 5, WISCONSIN

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

In Cooperation with the University of Wisconsin

STANDARD TERMS FOR DESCRIBING WOOD¹

Forest Products Laboratory,² Forest Service
U. S. Department of Agriculture

In discussing the properties and characteristics of different species of wood, it is often desirable to describe them broadly by means of descriptive terms, rather than by quoting precise numerical strength values. The practice of using general descriptive terms is well established in forest tree literature. Not so well established, however, is any uniformity in the use of descriptive terms; nor are the terms used nearly so closely correlated with the actual mechanical properties as is possible from existing knowledge. Thus, one book on trees describes American elm as "heavy, hard, strong, . . ." and describes red oak with the same words. This gives an impression of far closer equality of properties than really exists and fails to bring out the exceptional characteristics of each species.

In order to obviate the confusion that often arises from indiscriminate use of descriptive terms or the lack of properly correlated terms, the U. S. Forest Products Laboratory has developed a series of standard terms for describing wood. Ten terms have been set up for each property, thus giving a relatively wide range of expression. At the same time, the adoption of 10 terms permits the use of a corresponding decimal scale of numbers for each property in lieu of the descriptive terms, if so desired. Compare the greater precision of the standard terms in differentiating between American elm and red oak in the following example, as against the description previously quoted: (numbers in parentheses indicate the respective properties in the decimal scale)

American elm has large shrinkage (7), is moderately heavy (6), moderately strong in bending (6), moderately weak in compression (5), moderately stiff (6), moderately hard (6), and high in shock resistance (7).

Northern red oak has moderately large shrinkage (6), is heavy (7), strong in bending (7), moderately strong in compression (6), stiff (7), and high in shock resistance (7).

¹Originally written in 1936 by L. J. Markwardt and G. E. Heck; revised in 1956 by J. A. Liska and J. T. Drow.

²Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

From the descriptions presented with this more precise yardstick, it is very evident that American elm, for its weight, has a relatively large shrinkage and is unusually shock resistant; these are two of its particularly characteristic properties.

The various descriptive terms for six important properties are listed in table 1. Each descriptive term for each property embraces a given numerical classification range with definite numerical limits. The figures making up the classification limits are known as comparative strength values and are derived from specific numerical test data by means of reduction and weighing factors as explained in U. S. Department of Agriculture Technical Bulletin 158.³

Table 2 presents comparative strength values and corresponding descriptive terms for 178 species of wood grown in the United States. The descriptive terms are abbreviated in table 2, but the complete term can be readily ascertained by referring to table 1. For example, in table 2, the comparative figure for hardness of red alder is 48. Table 1 shows that the descriptive term corresponding to this hardness value is "moderately soft," which is abbreviated to "MS" in table 2.

When the results of standard test data on small clear specimens of any species are available, the required comparative strength values can be readily computed by the detailed procedure presented in Technical Bulletin 158. Conversely, when standard strength data are not available for a species, it is impossible to assign descriptive terms under the system presented here. For this reason, not all species listed in table 2 are fully described.

This system of standard descriptive terms was first developed by the U. S. Forest Products Laboratory more than 35 years ago, but it has been revised and expanded to include results of all species evaluations made to the present time. It is believed that the general use of standard terms will result in more precise evaluation of the various important physical properties of wood and eliminate the confusion resulting from the use of indiscriminate or uncorrelated terms.

³Comparative Strength Properties of Woods Grown in the United States, U. S. Dept. of Agr., Tech. Bull. 158. For sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 10 cents a copy (stamps not accepted).

Table 1.--Classification of comparative terms used in describing the properties¹ of the various species

Index figure	Specific gravity ² or weight		Shrinkage		Bending and compressive strength		Descriptive terms
	Classification limits	Descriptive terms	Classification limits	Descriptive terms	Classification limits	Descriptive terms	
1	Below 0.20	Extremely light	Below 53	Extremely small	Below 29	Below 36	Extremely weak
2	From .20 to .25	Exceedingly light	From 53 to 66	Exceedingly small	From 29 to 38	From 36 to 44	Exceedingly weak
3	From .25 to .30	Very light	From 66 to 80	Very small	From 38 to 48	From 44 to 53	Very weak
4	From .30 to .36	Light	From 80 to 95	Small	From 48 to 60	From 53 to 64	Weak
5	From .36 to .42	Moderately light	From 95 to 111	Moderately small	From 60 to 73	From 64 to 75	Moderately weak
6	From .42 to .50	Moderately heavy	From 111 to 132	Moderately large	From 73 to 91	From 75 to 89	Moderately strong
7	From .50 to .60	Heavy	From 132 to 159	Large	From 91 to 114	From 89 to 107	Strong
8	From .60 to .72	Very heavy	From 159 to 191	Very large	From 114 to 143	From 107 to 128	Very strong
9	From .72 to .86	Exceedingly heavy	From 191 to 228	Exceedingly large	From 143 to 179	From 128 to 153	Exceedingly strong
10	Above .86	Extremely heavy	Above 228	Extremely large	Above 179	Above 153	Extremely strong

Index figure	Hardness		Shock resistance		Stiffness	
	Classification limits	Descriptive terms	Classification limits	Descriptive terms	Classification limits	Descriptive terms
1	Below 7.7	Extremely soft	Below 18	Extremely low	Below 60	Extremely limber
2	From 7.7 to 13.5	Exceedingly soft	From 18 to 28	Exceedingly low	From 60 to 75	Exceedingly limber
3	From 13.5 to 21	Very soft	From 28 to 40	Very low	From 75 to 90	Very limber
4	From 21 to 34	Soft	From 40 to 58	Low	From 90 to 108	Limber
5	From 34 to 50	Moderately soft	From 58 to 79	Moderately low	From 108 to 126	Moderately limber
6	From 50 to 76	Moderately hard	From 79 to 111	Moderately high	From 126 to 150	Moderately stiff
7	From 76 to 120	Hard	From 111 to 160	High	From 150 to 180	Stiff
8	From 120 to 190	Very hard	From 160 to 230	Very high	From 180 to 216	Very stiff
9	From 190 to 295	Exceedingly hard	From 230 to 329	Exceedingly high	From 216 to 258	Exceedingly stiff
10	Above 295	Extremely hard	Above 329	Extremely high	Above 258	Extremely stiff

¹For reduction and weighing factors see table 4, U. S. D. A. Technical Bulletin 158.

²The specific gravity is based on weight when oven-dry and volume when green.

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms

Common and botanical name	Number of trees tested	Specific gravity	Volumetric shrinkage	Properties					Shock resistance
				Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	
HARDWOODS									
Alder, red (<i>Alnus rubra</i>)	6	0.37	123 ML	76 MS	81 MS	78 MW	139 MS	48 MS	72 ML
Apple (<i>Malus pumila</i>)	10	.61	170 VL	85 MS	75 MS	81 MW	138 MS	119 H	154 H
Ash:									
Black (<i>Fraxinus nigra</i>)	11	.45	144 L	75 MS	70 MW	73 MW	126 MS	64 MH	124 H
Blue (<i>Fraxinus quadrangulata</i>)	5	.53	113 ML	108 S	107 VS	108 S	138 MS	118 H	145 H
Green (<i>Fraxinus pennsylvanica</i>)	10	.53	122 ML	107 S	106 S	107 S	157 S	106 H	116 H
Oregon (<i>Fraxinus latifolia</i>)	3	.50	129 ML	88 MS	87 MS	88 MS	143 MS	94 H	125 H
Pampin (<i>Fraxinus profunda</i>)	3	.48	113 ML	85 MS	85 MS	85 MS	117 ML	103 H	87 MH
White (<i>Fraxinus americana</i>)	28	.54	130 ML	111 S	105 S	108 S	166 S	106 H	146 H
Aspen:									
Bigtooth (<i>Populus grandidentata</i>)	10	.35	116 ML	66 MW	70 MW	68 W	129 MS	38 MS	62 ML
Quaking (<i>Populus tremuloides</i>)	11	.35	111 ML	62 MW	57 W	60 W	112 ML	31 S	68 ML
Basswood, American (<i>Tilia americana</i>)	8	.32	158 L	61 MW	62 W	61 W	123 ML	30 S	53 L
Beech, American (<i>Fagus grandifolia</i>)	17	.56	162 VL	102 S	94 S	99 MS	168 S	96 H	134 H
Birch:									
Alaska paper (<i>Betula papyrifera</i> var. <i>humilis</i>)	10	.49	166 VL	88 MS	87 MS	88 MS	160 S	61 MH	126 H
Gray (<i>Betula populifolia</i>)	5	.45	147 L	61 MW	52 VW	57 VW	85 VL	52 MH	149 H
Paper (<i>Betula papyrifera</i>)	10	.48	158 L	78 MS	66 MW	73 MW	137 MS	58 MH	156 H
Sweet (<i>Betula lenta</i>)	10	.60	154 L	116 VS	105 S	111 S	206 VS	104 H	157 H
Yellow (<i>Betula alleghaniensis</i>)	17	.55	166 VL	106 S	99 S	103 S	174 S	87 H	172 VH
Black-mangrove (<i>Avicennia nitida</i>)	6	.83	157 L	127 VS	123 VS	125 VS	186 VS	191 :Exc. H	155 H
Buckeye, yellow (<i>Aesculus octandra</i>)	5	.33	118 ML	58 W	56 W	57 VW	111 ML	31 S	53 L
Buckthorn, cascara (<i>Rhamnus fr. shiana</i>)	5	.50	77 VS	71 MW	78 MS	74 MW	93 L	85 H	143 H

(Sheet 1 of 9)

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties									
		Specific gravity	Volumetric shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance		
Bustic, willow (<i>Dipholis salicifolia</i>)	1	0.86			128	Exc. S	230				
Butterbough	2	Exc. H	184	123	Exc. S	Exc. S	180	153	H		
Butternut (<i>Xylocopa paniculata</i>)	10	.73	VL	VS	111	VS	182	VS	180	H	
Butternut	10	.36	99	64	69	66	114	40	MS	80	
Button-mangrove (<i>Juglans cinerea</i>)	7	ML	MS	MW	107	W	159	124	MS	88	
California-laurel (<i>Conocarpus erectus</i>)	5	.69	144	92	VS	MS	88	VS	105	ME	
California-laurel (<i>Umbellularia californica</i>)	5	.51	L	S	74	MW	72	72	105	146	
Catalpa, northern (<i>Catalpa speciosa</i>)	15	H	ML	MW	60	62	110	43	MS	96	
Cherry:											
Black	5	.47	113	93	98	95	150	72	ME	112	
Pin (<i>Prunus serotina</i>)	5	.36	129	62	62	62	116	41	MS	78	
Chestnut: (<i>Fraxinus pennsylvanica</i>)	10	ML	ML	MW	W	W	ML	MS	MS	ML	
American (<i>Castanea dentata</i>)	5	.40	111	67	69	68	111	50	ME	69	
Japanese (<i>Castanea crenata</i>)	5	ML	ML	MW	MW	W	ML	50	ME	ML	
Chinkapin, golden (<i>Castanopsis chrysophylla</i>)	5	.54	125	128	97	115	147	75	ME	125	
Cottonwood:											
Black (<i>Populus trichocarpa</i>)	5	.42	128	82	76	79	123	62	ME	95	
Eastern (<i>Populus deltoides</i>)	5	ME	ML	MS	MS	MS	ML	ME	ME	ME	
Cucumber-tree (<i>Magnolia acuminata</i>)	5	.32	123	60	59	60	119	28	S	59	
Dogwood: (<i>Cornus florida</i>)	5	L	ML	MW	W	W	ML	S	ML	ML	
Flowering (<i>Cornus florida</i>)	5	.37	138	61	63	62	122	36	MS	72	
Pacific (<i>Cornus nuttallii</i>)	5	ML	L	MW	W	W	ML	MS	MS	ML	
Doveplum (<i>Coccoloba diversifolia</i>)	5	.44	137	89	87	88	174	56	ME	103	
Elder, blueberry (<i>Sambucus flauca</i>)	5	ME	L	MS	MS	MS	S	ME	ME	ME	
Elm: American (<i>Ulmus americana</i>)	12	.64	194	98	93	96	123	152	190	190	
Cedar (<i>Ulmus crassifolia</i>)	7	VH	Exc. L	S	S	MS	ML	VH	VH	VH	
		.58	168	86	93	89	142	114	114	159	
		H	VL	MS	S	MS	MS	H	H	H	
		.77	145	114	116	115	184	184	184	115	
		Exc. H	L	VS	VS	S	VS	VH	VH	H	
		.46	149	71	76	73	115	68	68	112	
		ME	L	MW	MS	MW	ML	ML	ML	H	
		.46	143	84	74	80	129	66	66	126	
		ME	L	MS	MW	MW	MS	ME	ME	H	
		.59	160	96	85	90	140	99	99	192	
		H	VL	S	MS	MS	MS	H	H	VH	

Table 2.—Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties																		
		Specific gravity	Volume- shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance											
Elm:																				
Rock (<i>Ulmus thomasii</i>)	10	0.57	137	106	97	102	147	104	190											
Slippery	6	.48	138	92	89	91	139	72	158											
(<i>Ulmus rubra</i>)																				
Winged	10	.60	159	101	84	94	150	106	224											
(<i>Ulmus alata</i>)																				
Eucalyptus, Tasmanian blue (<i>Eucalyptus globulus</i>)	5	.62	226	133	144	138	232	131	136											
Eugenia, redberry (<i>Eugenia confusa</i>)	3	.81	Exc. L	Exc. S	Exc. S	Exc. S	Exc. S	Exc. S	Exc. S											
(<i>Eugenia confusa</i>)																				
False-mastic (<i>Biderkylon foetidissimum</i>)	5	.89	123	112	127	118	183	211	96											
Fig, Florida strangler (<i>Ficus aurea</i>)	1	.44	.....	61	65	63	66	56	65											
(<i>Ficus aurea</i>)																				
Gumbo-limbo (<i>Bursera simaruba</i>)	5	.30	77	39	38	39	66	30	32											
(<i>Bursera simaruba</i>)																				
Hackberry (<i>Celtis occidentalis</i>)	6	.49	138	76	71	74	108	74	145											
(<i>Celtis occidentalis</i>)																				
Hawthorn, pear (<i>Crataegus calpodendron</i>)	2	.62	.....	89	79	85	107	126	162											
(<i>Crataegus calpodendron</i>)																				
Hickory:																				
Bitternut (<i>Carya cardiformis</i>)	11	.60	.....	126	132	129	169	.....	227											
(<i>Carya cardiformis</i>)																				
Mockernut (<i>Carya tomentosa</i>)	19	.64	182	134	124	130	184	.....	271											
(<i>Carya tomentosa</i>)																				
Nutmeg (<i>Carya myristiciformis</i>)	5	.56	.....	110	107	109	147	.....	215											
(<i>Carya myristiciformis</i>)																				
Pignut (<i>Carya glabra</i>)	60	.66	182	143	130	137	195	.....	308											
(<i>Carya glabra</i>)																				
Shagbark (<i>Carya ovata</i>)	24	.64	170	132	122	128	185	.....	258											
(<i>Carya ovata</i>)																				
She'llbark (<i>Carya laciniosa</i>)	19	.62	195	126	103	116	164	.....	308											
(<i>Carya laciniosa</i>)																				
Water (<i>Carya aquatica</i>)	2	.61	.....	126	115	121	185	.....	190											
(<i>Carya aquatica</i>)																				
Holly, American (<i>Ilex opaca</i>)	5	.50	155	76	70	73	101	85	120											
(<i>Ilex opaca</i>)																				
Honeylocust (<i>Gleditsia triacanthos</i>)	6	.60	108	111	109	110	153	154	145											
(<i>Gleditsia triacanthos</i>)																				
Hophornbeam, eastern (<i>Ostrya virginiana</i>)	5	.63	183	100	98	99	149	124	169											
(<i>Ostrya virginiana</i>)																				

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Specific gravity	Volumetric shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Hornbeam, American (<i>Carpinus caroliniana</i>)	12	0.58	184	77	67	73	114	117	290
Leadwood (<i>Krugiodendron ferreum</i>)	4	1.04	125	157	159	158	ML	H	Exc. H
Locust, black (<i>Robinia pseudoacacia</i>)	3	Ext. H	ML	Exc. S	Ext. S	Exc. S	Exc. S	Exc. S	104
Madrone, Pacific (<i>Arbutus menziesii</i>)	6	.66	103	157	165	160	219	160	167
Magnolia (<i>Magnolia fraseri</i>)	5	VH	MS	Exc. S	Ext. S	Exc. S	Exc. S	VH	VH
Fraser (<i>Magnolia fraseri</i>)	5	.58	174	85	87	86	116	112	101
Southern (<i>Magnolia grandiflora</i>)	2	H	VL	MS	MS	MS	ML	H	MH
Mangrove (<i>Rhizophora mangle</i>)	4	.40	126	76	73	75	141	50	81
Maple (<i>Acer rubrum</i>)	5	ML	ML	MS	MW	MW	MS	MH	MH
Big leaf (<i>Acer macrophyllum</i>)	5	.46	122	81	71	77	136	80	141
Black (<i>Acer nigrum</i>)	1	MH	ML	MS	MW	MW	MS	H	H
Red (<i>Acer rubrum</i>)	14	.89	158	178	156	169	270	247	174
Silver (<i>Acer saccharinum</i>)	5	Ext. H	L	Exc. S	Ext. S	Exc. S	Ext. S	Exc. H	VH
Striped (<i>Acer pennsylvanicum</i>)	4	.44	113	82	85	85	131	72	77
Sugar (<i>Acer saccharum</i>)	22	.52	140	MS	MS	MW	MS	MH	ML
Mountain-laurel (<i>Kalmia latifolia</i>)	5	H	L	S	S	S	149	96	132
Oak: (<i>Quercus velutina</i>)	8	.49	128	93	86	MS	155	79	111
Black (<i>Quercus velutina</i>)	5	MH	ML	S	MS	MS	S	H	H
Bur (<i>Quercus macrocarpa</i>)	5	.44	114	68	70	69	106	64	92
California black (<i>Quercus kelloggii</i>)	10	MH	ML	MW	MW	W	L	MH	MH
Caryon live (<i>Quercus chrysolepis</i>)	3	.44	121	78	72	75	135	59	99
Cherrybark (<i>Quercus falcata var. pagodaefolia</i>)	3	.56	147	MS	MW	MW	MS	MH	MH
Chestnut (<i>Quercus prinus</i>)	5	.62	144	114	104	110	178	115	137
		VH	L	VS	S	S	S	H	H
		.70	158	97	90	94	110	142	114
		.61	163	S	S	MS	ML	VH	H
		.57	162	98	90	95	142	103	127
		H	VL	S	S	MS	MS	H	H
		.58	129	82	81	82	103	112	111
		.51	115	MS	MS	MW	L	H	H
		.70	158	69	71	70	94	98	76
		.61	163	MW	MW	W	L	H	ML
		.57	162	109	124	115	158	179	132
		H	VL	S	VS	S	S	VH	H
		.61	163	131	122	127	215	123	163
		.57	162	VS	VS	VS	VS	VH	VH
		H	VL	101	92	97	166	89	106
			VL	S	S	MS	S	H	MH

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties							Shock resistance	
		Specific gravity	Volümetric shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness		
Oak:										
Gambel (<i>Quercus gambelii</i>)	3	0.62	121	69	65	67	78	137	138	H
Laurel (<i>Quercus laurifolia</i>)	5	.56	173	93	89	91	169	98	121	H
Live oak (<i>Quercus virginiana</i>)	5	.81	152	142	129	136	228	240	148	H
Northern red oak (<i>Quercus rubra</i>)	33	Exc. H	151	VS	Exc. S	VS	Exc. S	Exc. H	141	H
Oregon white oak (<i>Quercus garryana</i>)	10	.56	131	99	88	94	164	103	126	H
		.64	133	86	88	87	107	152		H
		VH	L	MS	MS	MS	L	VH		H
Overcup (<i>Quercus lyrata</i>)	7	.57	167	90	79	85	156	87	133	H
Pin (<i>Quercus palustris</i>)	5	.58	143	96	92	94	167	111	147	H
Post (<i>Quercus stellata</i>)	10	.60	160	98	89	94	143	122	132	H
Scarlet oak (<i>Quercus coccinea</i>)	5	.60	140	115	107	112	181	120	174	VH
Southern red oak (<i>Quercus falcata</i>)	4	.52	153	83	76	80	152	86	84	ME
		H	L	MS	MS	MW	S	H		
Swamp chestnut (<i>Quercus michauxii</i>)	4	.60	180	100	95	98	171	103	131	H
Swamp white oak (<i>Quercus bicolor</i>)	1	.64	172	123	116	120	185	122	164	VH
Water white (<i>Quercus nigra</i>)	20	.56	154	110	95	104	195	100	140	H
White willow (<i>Quercus alba</i>)	2	.56	175	102	97	100	153	108	127	H
		H	VL	S	MS	MS	S	106	116	H
Osage-orange (<i>Maclura pumifera</i>)	1	.76	89	40	39	40	54	25	52	L
Palmetto, cabbage (<i>Sabal palmetto</i>)	4	.33	82	41	44	42	Ext. L	S	21	Exc. L
Paradise-tree (<i>Sinarauba glauca</i>)	5	.60	137	109	104	107	161	140	157	H
Pecan (<i>Carpa illinoensis</i>)	5	.64	183	120	115	118	171	159	135	H
Peredimon, common (<i>Diospyros virginiana</i>)	5	VH	VL	VS	VS	S	S	VH		H

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties									
		Specific gravity	Volumetric shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance		
Poisontree, Florida (<i>Metopium taxiferum</i>)	4	0.51	115	69	56	63	99	56	48		
Poplar, balsam	10	.30	104	48	48	94	25	ME	L		
Rhododendron, rosebay (<i>Populus balsamifera</i>)	5	.50	158	75	84	100	103	Exc. W	L		
Sassafras	5	.42	103	71	70	102	60	H	ME		
Servissberry, downy (<i>Rhododendron maximum</i>)	5	.66	183	120	113	181	130	ME	ME		
Silverbell, Carolina (<i>Amelanchier arborea</i>)	5	.42	122	74	72	73	53	VH	VE		
Sourwood (<i>Galesia carolina</i>)	5	.50	152	93	86	159	83	MS	ME		
Sugarberry (<i>Oxydendrum arboreum</i>)	5	.47	126	74	74	102	82	H	ME		
Sumac, staghorn (<i>Celtis laevigata</i>)	5	.45	ML	73	74	73	64	H	H		
Sweetbay (<i>Rhus typhina</i>)	4	.45	129	82	77	164	51	ME	H		
			ML	MS	MS	S	ME	ME	ME		
Sweetgum (<i>Liquidambar styraciflua</i>)	25	.46	160	85	78	148	61	MS	ME		
Sycamore, American (<i>Platanus occidentalis</i>)	10	.46	137	74	76	129	64	MS	ME		
Tamarisk (<i>Tamarix sp.</i>)	3	.62	145	97	91	126	110	MS	ME		
Tanoak (<i>Lithocarpus densiflorus</i>)		.56	171	126	128	186	H	MS	H		
Tupelo: Black (<i>Nyssa sylvatica</i>)	5	.46	133	82	77	117	76	Exc. S	ML		
Water (<i>Nyssa aquatica</i>)	6	.46	123	82	86	127	77	MS	H		
Walnut: Black (<i>Juglans nigra</i>)	5	.51	116	111	111	167	87	MS	ME		
Little (<i>Juglans microcarpa</i>)	1	.53	101	91	85	118	H	S	H		
Willow Black (<i>Salix nigra</i>)	20	.35	127	57	52	95	39	MS	ME		
Pacific (<i>Salix lasiandra</i>)	5	.39	132	66	61	126	50	L	ME		
		ML	ML	MS	W	MS	ME	W	ME		

Table 2.--Properties of woods grown in the United States as measured by comparative methods and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties							
		Specific gravity	Volume shrinkage	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Witch-hazel (<i>Hamamelis virginiana</i>)	5	0.56	188	107	86	98	129	105	171
Yellow-poplar (<i>Liriodendron tulipifera</i>)	19	.40	122	76	72	74	151	44	76
SOFTWOODS									
Baldypress	26	.42	103	79	93	85	139	52	72
(<i>Taxodium distichum</i>)		ME	MS	MS	S	MS	MS	ME	ML
Cedar:									
Alaska	8	.42	91	80	85	82	136	52	94
(<i>Chamaecyparis nootkatensis</i>)		ME	S	MS	MS	MS	MS	ME	ME
Atlantic white	10	.31	83	53	60	56	93	35	51
(<i>Chamaecyparis thyoides</i>)		L	S	W	W	VW	L	MS	L
Eastern redcedar	5	.44	78	67	87	76	80	82	115
(<i>Juniperus virginiana</i>)		ME	VS	MS	MS	MS	VL	H	H
Incense	8	.35	80	68	83	74	107	50	54
(<i>Libocedrus decurrens</i>)		L	S	MS	MS	MS	L	ME	L
Northern white	5	.29	69	50	52	51	77	30	46
(<i>Thuja occidentalis</i>)		VL	VS	W	VW	VW	VL	S	L
Port-Orford	14	.40	106	81	90	85	168	48	81
(<i>Chamaecyparis lawsoniana</i>)		ML	MS	MS	S	MS	S	MS	ME
Southern redcedar	5	.42	67	87	108	96	109	76	62
(<i>Juniperus silicicola</i>)		ME	VS	MS	VS	MS	ML	H	ML
Western redcedar	15	.31	76	60	75	66	108	38	52
(<i>Thuja plicata</i>)		L	VS	MS	MS	W	ML	MS	L
Cypress, Arizona	10	.51	99	87	91	89	92	101	80
(<i>Cupressus arizonica</i>)		H	MS	MS	S	MS	L	H	ME
Douglas-fir:									
Coast type	67	.45	122	90	104	96	185	58	86
(<i>Pseudotsuga menziesii</i>)		ME	ML	MS	S	MS	VS	ME	ME
Intramontane type	15	.41	113	81	91	85	161	56	72
(<i>Pseudotsuga menziesii</i>)		ML	ML	MS	S	MS	S	ME	ML
Rocky Mountain type	10	.40	103	75	85	78	142	52	66
(<i>Pseudotsuga menziesii</i> var. <i>glauca</i>)		ML	MS	MS	MS	MS	MS	ME	ML
Fir:									
Balsam	5	.34	103	58	66	61	117	30	49
(<i>Abies balsamea</i>)		L	MS	W	MS	W	ML	S	L
Californian red	17	.37	117	73	77	75	146	45	68
(<i>Abies magnifica</i>)		ML	ML	MS	MS	MS	MS	MS	ML
Corkbark	10	.28	92	51	57	54	104	27	38
(<i>Abies lasiocarpa</i> var. <i>arizonica</i>)		VL	S	W	W	VW	L	S	VL
Grand	10	.37	105	72	80	76	156	42	73
(<i>Abies grandis</i>)		ML	MS	MS	MS	MS	S	MS	ML
Noble	9	.35	126	73	78	75	155	39	68
(<i>Abies procera</i>)		L	ML	MS	MS	MS	S	MS	ML

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Specific gravity	Volumetric shrinkage	Properties						
				Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance	
Fir:										
Pacific silver (<i>Abies emabilis</i>)	6	0.35	142	70	76	75	146	36	71	
Subalpine (<i>Abies lasiocarpa</i>)	5	.31	92	50	59	54	95	34	34	
White (<i>Abies concolor</i>)	20	.35	97	72	73	72	127	42	58	
Hemlock:										
Eastern (<i>Tsuga canadensis</i>)	20	.38	97	72	79	75	121	51	67	
Mountain (<i>Tsuga mertensiana</i>)	10	.43	115	81	87	84	130	64	99	
Western (<i>Tsuga heterophylla</i>)	18	.38	120	74	85	79	145	50	73	
Juniper:										
Alligator (<i>Juniperus deppeana</i>)	3	.48	73	63	76	69	60	107	79	
Rocky Mountain (<i>Juniperus scopulorum</i>)	10	.40	68	72	77	74	Exc.L	64	84	
Utah (<i>Juniperus osteasperma</i>)	10	.47	85	85	89	87	Exc.L	ME	ME	
Larch, western (<i>Larix occidentalis</i>)	33	.51	138	97	106	101	179	63	107	
Pine:										
Eastern white (<i>Pinus strobus</i>)	26	.34	82	62	66	64	117	33	54	
Jack (<i>Pinus banksiana</i>)	35	.40	103	72	76	74	123	45	79	
Jeffrey (<i>Pinus jeffreyi</i>)	5	.37	103	68	70	69	116	43	63	
Limber (<i>Pinus flexilis</i>)	2	.37	80	69	68	69	106	39	54	
Loblolly (<i>Pinus taeda</i>)	56	.47	123	87	92	89	162	57	94	
Lodgepole (<i>Pinus contorta</i>)	28	.38	114	67	72	69	128	41	60	
Longleaf (<i>Pinus palustris</i>)	54	.54	123	103	115	108	186	71	109	
Pitch (<i>Pinus rigida</i>)	10	.45	110	80	76	78	146	56	94	
Pond (<i>Pinus serotina</i>)	5	.50	115	88	102	94	154	63	92	
Ponderosa (<i>Pinus ponderosa</i>)	31	.38	98	64	69	66	113	41	57	

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties										
		Specific gravity ¹	Volumetric shrinkage ²	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance			
Pine:												
Red (Pinus resinosa)	15	0.41	112	74	76	75	148	42	79			
Sand (Pinus clausa)	5	.45	104	85	89	87	134	63	ME			
Shortleaf (Pinus echinata)	42	.46	122	87	92	89	161	56	ME			
Slash (Pinus elliotii)	25	.54	124	105	114	109	186	76	ME			
South Florida slash (Pinus elliotii var. densa)	5	.70	133	121	122	121	198	108	H			
Sugar (Pinus lambertiana)	9	.35	81	64	70	67	112	37	33			
Table-Mountain (Pinus pungens)	5	.49	107	90	93	91	150	63	L			
Virginia (Pinus virginiana)	26	.45	118	88	87	88	141	60	ME			
Western white (Pinus masticola)	14	.36	117	68	76	72	145	34	H			
Pinyon (Pinus edulis)	13	.48	100	65	65	65	93	53	66			
Redwood (old growth) (Sequoia sempervirens)	16	.38	69	82	102	91	136	54	ML			
Spruce:												
Black (Picea mariana)	5	.38	112	68	69	68	143	40	82			
Engelmann (Picea engelmannii)	18	.32	108	60	62	61	114	33	ME			
Red (Picea rubens)	11	.38	117	72	77	74	138	41	51			
Sitka (Picea sitchensis)	25	.37	116	72	76	74	144	45	L			
White (Picea glauca)	15	.37	129	68	71	69	120	39	69			
Tamarack (Larix laricina)	5	.49	128	84	94	88	147	53	ML			
Yew, Pacific (Taxus brevifolia)	5	.60	96	115	113	114	120	136	ME			
		VH	MS	VS	VS	S	ML	VH	165	VH		

¹Based on volume when green and weight when oven-dry.

²Shrinkage from green to oven-dry condition based on dimensions when green.